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[*NOTE.—References to Insects and Fungi are indexed under the headings "Insects" and "Fungi" only.*]

Articles or reports on the following subjects appear in the *Journal* each month and are not separately indexed:—Notes on the Weather, Notes on Agricultural Labour in England, Notes on Crop Prospects from the Statistical Bulletin of the International Agricultural Institute, Reviews of the Corn Markets, the Live and Dead Meat Trade, and the Provision Trade, Prices of Agricultural Produce, Outbreaks under Diseases of Animals Acts, Lists of Additions to the Board's Library, and Selected Contents of Periodicals.

THE JOURNAL
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APRIL, 1910.

THE SCLEROTINIA (*BOTRYTIS*) DISEASE OF THE GOOSEBERRY, OR "DIE-BACK."

E. S. SALMON, F.L.S.,
Mycologist to the South-Eastern Agricultural College, Wye, Kent.

THE *Sclerotinia* disease of the gooseberry—or "die-back," as it is called in some districts in Kent—has already received some attention in this country.* In the present article some fresh facts are given as to the life-history of the fungus, and certain measures are described which in practice have been found successful in dealing with the disease.

The disease is widespread in England, and is liable to occur wherever gooseberries are grown, whether in plantations or in the private garden. It attacks bushes growing on stiffish clay as well as bushes growing on light, gravelly or stony soils. I have seen it doing considerable mischief in Kent (especially round Sittingbourne and Faversham, and in the Sandwich district †), Surrey and Sussex, and specimens have been sent to me from Hampshire, Herefordshire, Worcestershire, Gloucestershire, Somersetshire, Devonshire, Essex, Berkshire, and Middlesex.

Reports from various parts of the country have been received of young plantations—very probably planted up with diseased cuttings taken from affected bushes—having suffered severely from the outset. Within the last few years bushes killed by *Sclerotinia* have been sent in by growers under the impression that the American Gooseberry Mildew had invaded their plantations and done this mischief. As a

* A. L. Smith, in *Journal of Botany*, 1903, p. 19; W. Carruthers, in *Jour. Roy. Agric. Soc. of England*, vol. 63, p. 291, and vol. 67, p. 262.

† In East Kent the variety known as "Sandwich Yellow" or "Cousins' Seedling" is very subject to attack.

matter of fact, as is shown by the illustrations, there is no resemblance between these two diseases.

Description of the Disease.—The gooseberry bush may be attacked in four distinct places, viz., the main stem and base of the branches, the young wood of the current year, the leaf, or the berry. First, as regards a bush attacked in the main stem. The spawn (*mycelium*) of the fungus penetrates into the tissue of the stem (permeating the cortex and bast), and at the end of a season's growth causes the bark to crack and peel off, often in large pieces. The part of the stem first attacked is usually that portion situated at the ground level or a little above it; eventually the spawn of the fungus "rings" the stem at this place and the whole bush is killed. Before this occurs, however—and death does not occur as a rule in the case of a well-grown bush until after several seasons from the time it was first attacked—the spawn of the fungus spreads upward in the stem to the base of the branches. Here it frequently attacks some of the branches so severely that they die. The presence of dead branches in a few bushes, or the death of half the bush, is a characteristic sign of the first appearance of the *Sclerotinia* disease in a plantation. And, as is noted below, it is at this time that steps should be taken to stop the disease.

Now, renewed growth in the spawn of the fungus in the stem takes place every spring, and it is at this time that the manner in which the fungus exists and spreads can be most easily seen. If a diseased stem be examined during a warm and damp spell of weather in the spring, the appearance shown in Fig. 1 will be observed. The bark will be found to be peeling or cracking off, while, as may be seen, greyish, fluffy patches of a "mould" have appeared at the edges of the peeling bark or in the fissures where the bark is cracked. If there is a dead branch on the bush, then, as a rule, small greyish tufts or little cushions—which soon develop in suitable weather into fluffy patches such as are shown in Fig. 1—will be found scattered here and there over its surface, as shown at × in Fig. 2. These tufts of the fungus occur both on the main branches nearly down to their base (see Fig. 2), and frequently also on the younger wood (see Fig. 3). If with the point of a knife a little of the fluffy growth shown in Fig. 1,

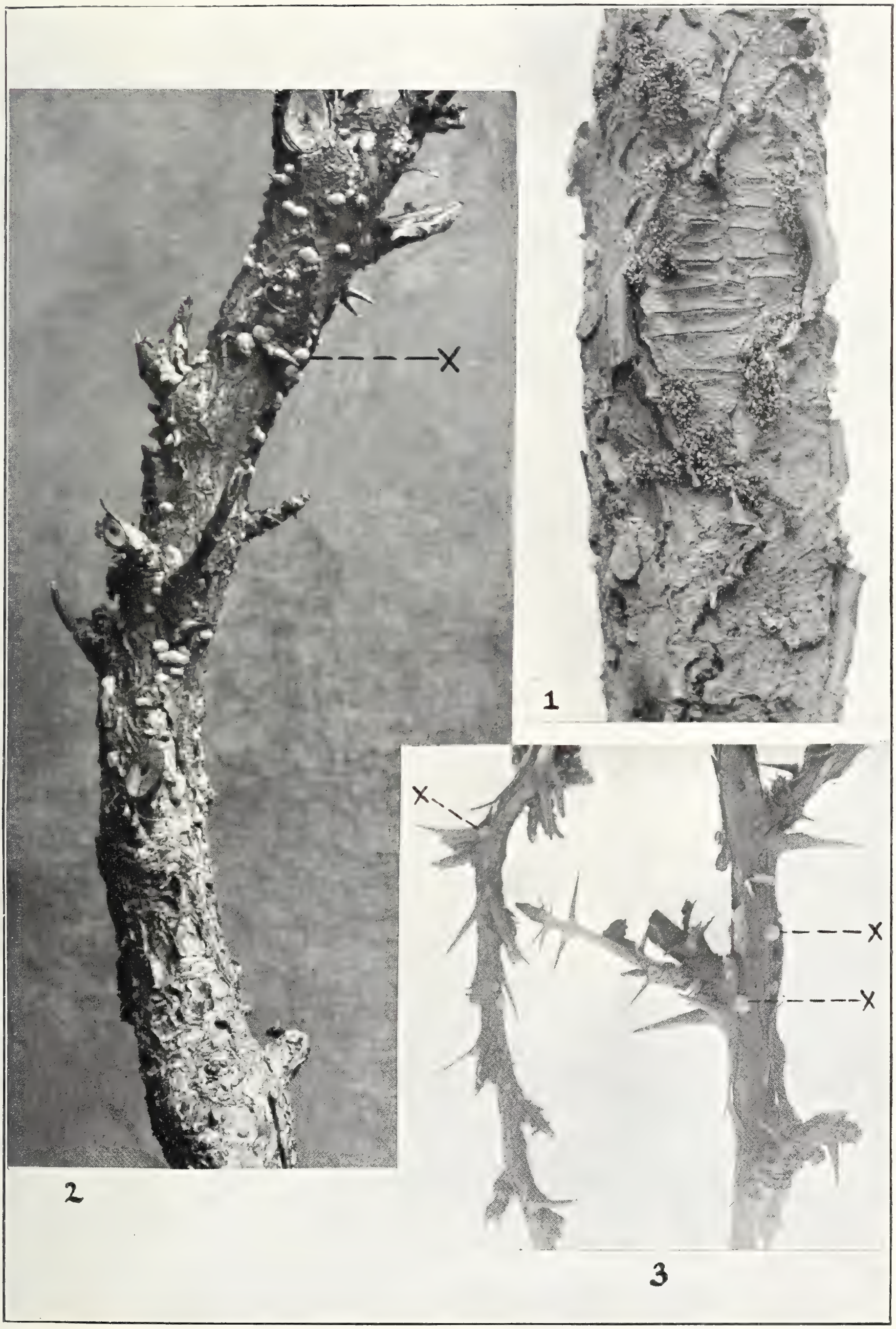

FIG. 1.—Portion of stem (just above ground level) of a gooseberry bush attacked by *Sclerotinia*; fructifications of *Botrytis* can be seen appearing between the cracks of the bark.

FIG. 2.—Part of an old diseased branch; compact cushion-like tufts of *Botrytis* (x) have been formed on its surface.

FIG. 3.—Portions of young diseased branches, bearing compact cushion-like tufts of *Botrytis* (x).

or of the more compact tufts shown at × in Figs. 2 and 3, is taken and placed in a drop of water under the microscope, the structure will be seen to be the same. In both cases the fructification shown at Fig. 4 will be seen. We see (to the left) a number of upright branches (*conidiophores*) rising from the spawn of the fungus which creeps horizontally; these upright branches are brown in colour and bear side branches which, as well as the main branches, give rise at

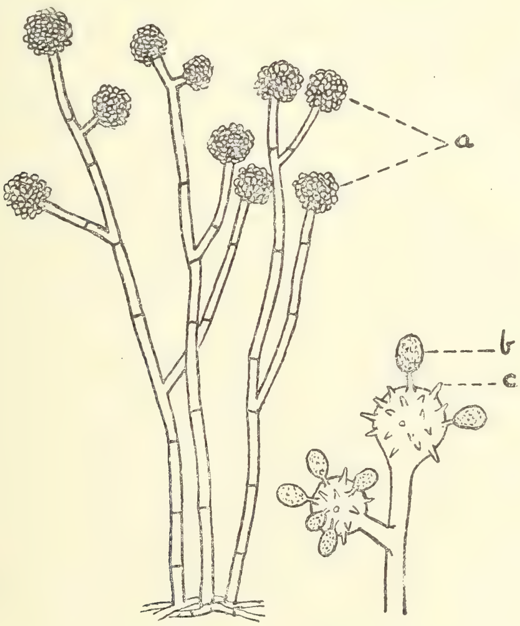

FIG. 4.—Fructification of *Botrytis*; *to left*, group of three branched *conidiophores* bearing heads of spores (*a*); *to right*, apex of main branch of a *conidiophore* and of one of its side branches, showing the way the *spores* (*b*) are borne on minute stalks, or *sterigmata* (*c*). Highly magnified.

the tip to a roundish head of very minute oval *spores* (*a* in Fig. 4.) A large number of these very minute spores (which measure about $10\mu \times 5\mu$ *) are produced in each head. In the drawing to the right (Fig. 4) the tip of a main branch, and of its side branch, is shown more highly magnified; here most of the spores have fallen off, but some of the spores (*b* in Fig. 4) can be seen attached to the little stalk (*sterigma*) (*c* in Fig. 4) on which they are borne. It is these crowded upright branches, or *conidiophores*, densely packed side by side, and each bearing numerous heads of many thousands

* μ = one-thousandth of a millimeter.

of spores, which give the tufts of the fungus its characteristic fluffy or minutely powdery appearance. Each spore of the fungus, it must be noted, is able, just like the seed of higher plants, to give rise to another distinct individual of the same kind, and thus spreads the disease.

The fructification shown in Fig. 4 has long been known under the name of *Botrytis*. It has lately been discovered, however, that this is a stage of a fungus called *Sclerotinia*. Turning to Fig. 1 again, we should find, if we looked carefully into the cracks of the bark where the *Botrytis* fructifications are appearing, that while some spring directly from the spawn of the fungus hidden in the tissues of the stem, others arise from small, hard, blackish bodies, a few millimeters long and of irregular shape. These little blackish bodies consist of a dense compact mass of thin-walled, colourless, fungus tissue within; and on the outside of a protective layer of dark-coloured, thicker-walled cells. Such bodies are called *sclerotia;* they are extremely resistant to climatic conditions such as frost, drought, etc., and serve to carry the fungus through all vicissitudes from one growing season to the next. In Fig. 5 is given a microphotograph of portions of two *sclerotia* which have partly grown together; one (to the left) has just commenced to grow again, and to produce a tuft of *conidiophores,* the basal portions of which are visible. These *sclerotia* are able under certain conditions to give rise to another form of fructification in which winter-spores (*ascospores*) are produced. In this stage the fungus has been known under the name of *Sclerotinia,* while the name *Botrytis* has been applied to the stage (shown in Figs. 1, 2, 3, 4) where summer-spores only are produced. It is probable that the *Sclerotinia* stage, with its winter-spores, only rarely occurs. It is certain that the disease can be perpetuated from season to season in its absence by means of the *Botrytis* stage, which by means of summer-spores spreads the disease during the growing season, and then remains dormant in the form either of mycelium in the stem or of sclerotia on its surface—both enabling the fungus to hibernate during severe winters. I have frequently seen, as early as February, numerous powdery tufts of *conidiophores* on the surface of an affected stem; it is probable that such survive all through mild winters

—just as the summer stage of the apple "scab" fungus may be found on the young wood of apple trees throughout mild winters.

If an affected bush has been weakened by the *Sclerotinia* disease in previous seasons, the renewed growth of the fungus during the spring will frequently cause the death of the bush. In the affected plantation gooseberry bushes here and there will suddenly wilt and die out in all stages of growth; this occurs most frequently at the time when the leaf-buds have just burst open, but often also at a later stage when the bush is in full flower or bearing young berries. If such bushes are examined the stem will be found to be "ringed" by the spawn of the fungus, and on the surface of the stem will be found the *Botrytis* fructification as shown in Fig. 1. If the disease has not developed to a sufficient extent to kill the bush, the spores which are continually being produced throughout the spring and early summer serve to spread the disease to other parts of the bush.

Very commonly the spores affect the leaves, which under the attack soon show a discoloration at their edges. The edges of the leaves are first turned yellowish, and finally become ashy-grey or whitish, as shown in the photograph at Fig. 6. If the attack extends from the edge of the leaf inwards until the greater part of the leaf is affected—as is the case with many of the leaves shown in Fig. 7—the fall of the leaf soon takes place; if, however, as is often the case, the injury remains restricted to the edges of the leaves, the latter remain on the bush until the usual time for the fall of the leaf. Whether the injury spreads over the leaf to such an extent as to make it fall prematurely seems to depend on the climatic conditions which prevail at the time. When a large number of leaves are attacked throughout a plantation and made to fall prematurely, serious damage is often inflicted; in such cases the berries produced are much smaller than on healthy bushes, and a quantity of unripened spindly shoots may be formed. The under-surface of the leaf is the part attacked, and during the months of June and July the *Botrytis* fructification may be found here on leaves which show the appearance represented in Figs. 6 and 7.

Another part of the bush which may be attacked is the

young wood. In the case of young bushes especially, a considerable proportion of the young shoots may be attacked and much weakened or killed—a fact which has caused growers to speak of the present disease as "die-back." In many of the shoots which are thus killed, the fungus can be found wintering in the dead buds, and producing fresh *conidiophores* in the following spring. Such a dead shoot is shown in Fig. 7. These infested dead shoots may constitute a prolific source of infection. If, as I have seen happen in not a few cases, the prunings of *Botrytis*-affected bushes are left lying in a heap in a corner of the plantation or garden (instead of being promptly burned), they will develop during the following spring an abundant crop of powdery tufts of *Botrytis,* the spores of which, carried by the wind in countless numbers, will spread the disease through the plantation. There is also the danger of cuttings being taken from *Botrytis*-infected bushes, when many of the young bushes thus obtained will become diseased. In one case which was investigated it was found that a lot of 2,000 young bushes of "Crown Bob," planted out direct from a nursery, were already diseased—the young shoots harbouring the *Botrytis*-stage of the fungus.

Lastly, the fungus occasionally attacks the berry and turns it rotten. I have seen berries attacked and destroyed in plantations in Kent, Surrey and Somerset. The first sign of the appearance of the disease on the berry is the browning of the skin at some spot; this browning gradually extends until one side of the berry shows obvious signs of softening and of being badly diseased. The *Botrytis* fructification, in the form of the characteristic ashy-grey "mould," then soon appears on the surface of the discoloured portions (see Fig. 8), and the berry in a week or so is turned completely rotten and decays. A case which occurred last season at Reigate, Surrey, may be mentioned as showing the course usually followed by the disease and the manner in which it spreads through the bush from one part to another. In this case the bushes, which were of the "Lancashire Lad" variety, were growing in a garden. At the beginning of June a number of the berries hanging on several of the bushes attracted attention by suddenly appearing "blighted"; it was also

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. 5.—Portions of two *Sclerotia* (partly grown together), in section, showing the dark-coloured protective outer layer. The *Sclerotium* to the left has commenced to give rise to the *Botrytis* fructification. Magnified.

. 6.—Shoot of "Whinham's Industry," with the leaves attacked at the edges by *Botrytis*.

. 7.—Two shoots of "Whinham's Industry," showing the leaves affected more severely, and a young shoot (*to right*) killed by the fungus.

. 8.—Five gooseberries attacked and turned rotten; the *Botrytis* fructification has developed on their surface.

noticed that many of the berries were turning flabby instead of ripening, and fell to the ground where, after a day or two, they became covered with the same "mould." An examination of the berries showed the presence of *Botrytis*. Throughout the first fortnight of June the disease continued to spread, and finally the grower was obliged to gather the crop green in order to save those not already attacked. The source of this epidemic became apparent when the grower forwarded examples of the old branches and young wood from these bushes, since, scattered here and there on the surface of these, were numerous vigorous tufts of *Botrytis* as shown in Figs. 2 and 3. These tufts were powdery with enormous numbers of *spores*, and it was these *spores*—carried through the bushes by the wind or insects—which constituted a continuous source of infection to the berries. The leaves of these bushes had not yet been attacked, and this made the "blighting" of the berries appear all the more strange, as otherwise there were no signs of disease evident—the tufts of *Botrytis* on the dying (not dead) branches not being apparent until searched for closely.

The details in the following case, where the berries were attacked in the plantations of the National Fruit and Cider Institute, Long Ashton, near Bristol, have been supplied by the Director, Mr. B. T. P. Barker: "The bushes have been planted about five years, and are situated between bush apples. During 1908 and 1909 we lost about twenty bushes —out of a total of 750 in our plantations—owing to attacks of the fungus on the main stem. In addition, very many bushes were more or less seriously mutilated by attacks on the branches. In 1908 the foliage suffered seriously; this season the damage in this way has been slight, but the fruit has been attacked. A number of berries were attacked when ripe or nearly ripe; to all appearance the berries were perfectly sound and undamaged in any way up to the time of attack by the fungus. Not a large proportion of the berries was affected; it would be very serious if the trouble were to develop, as the fruit is absolutely ruined when attacked. Similar damage has been common in market gardens in this locality."

Remedies.—The best measures to get rid of the disease

are the prompt removal and burning of all dead bushes or dead branches in the plantation. As soon as the leaves of bushes show the appearance represented in Fig. 6, the bushes in the plantation generally should be examined and any bush found with the main stem diseased should be grubbed up and burned. The prompt removal of all dead (or dying) bushes, carried out for a few seasons, has proved more efficacious against this disease than spraying. It must not be forgotten that this fungus (unlike the American Gooseberry Mildew) is capable of developing vigorously on *dead* parts of the bush. In nearly every case—except in the comparatively rare ones where a plantation has been planted up with *Botrytis*-infested young bushes — the disease appears first either on single bushes scattered here and there through the plantation, or on all the bushes over a small patch of ground in the plantation, while the surrounding bushes are healthy. If the disease on its first appearance is dealt with summarily by the burning of all dead bushes and dead branches, there is no need to spray or to take any other remedial measures, since the disease soon completely disappears.

Where the disease has been allowed to become severe and widespread, or where it is not in the power of the grower to remove entirely the source of the disease, spraying must be resorted to—in addition, of course, to the prompt burning of all dead bushes. A heavy spraying with a solution of copper sulphate (4 lb. dissolved in 100 gallons of water) should be given just before the buds burst, with the object of destroying the tufts of *Botrytis* shown in Figs. 1, 2, and 3, care being taken to spray heavily the main stems of the bushes. The infection and premature falling off of the leaves may be prevented by spraying, directly the fruit is set, with Bordeaux mixture made of the strength and in the manner described in this *Journal* for June, 1908 (Vol. XV., p. 291.) In this spraying it is essential that the under-surface of the leaves should be sprayed as much as possible. No injury follows the application of Bordeaux mixture of this strength, and if the spraying be done at the time indicated no spotting of the berries occurs.

It may be noted, finally, that any treatment which induces

the bushes to make vigorous growth tends to stop the attacks of the fungus; whereas the opposite is the case with the American Gooseberry Mildew, which most severely attacks vigorously growing bushes. The former characteristic is illustrated by the following case: A number of "Crown Bob" bushes on which the current year's growth of wood had died back through being badly attacked by *Botrytis* were planted in an old arable field, part of which was heavy clay with plenty of moisture, and part was of a much more friable nature, with a gravelly subsoil. All the bushes were pruned into two years' old wood before being transplanted. Those bushes which were planted in the heavy clay land made excellent growth the next season and showed no disease, while the remainder, which were on drier soil (though in the same field and adjoining the others), grew less vigorously and again became severely attacked by *Botrytis*.

SMALL HOLDINGS IN SURREY.

GORDON HARLEY GRELLIER, P.A.S.I.

Although it is generally thought that there are few small holdings, as the term is popularly understood, in the county of Surrey, there is still a substantial number of holdings of from 5 to 50 acres, the occupiers of which are either dependent on the land for a living, or use it to supplement their incomes. Speaking generally, these holdings are not found grouped together, but scattered over the county. In wide unbroken stretches of agricultural land, the farms are generally from 200 to 1,000 acres in extent, but even in these districts, and where least expected, small holders may be found. Surrey, however, is a county of commons, heaths and woods, and it is in and about these that many of the small holdings are located.

Climate and Soil.—The climate upon the whole is dry, particularly on the open sandy heaths about Bagshot, but the soil varies considerably, and it may be said that Surrey contains some of the best land and some which is as poor as any in the country. The largest area of uniform soil is that of the flat low-lying district in the south, known as the Weald, which can only be profitably worked by those possessing considerable capital and skill, and is therefore unsuitable for

the small holder. To the north of the Weald is a belt of sandy loam, narrow towards the east, and widening as it approaches the western border of the county. It is of great depth, and speaking generally, the western portion (except round Godalming, where the stone locally called Bargate comes near to the surface) is loose sand, covered with heath, and of little use for agricultural purposes. This belt is separated from the chalk downs by a very narrow strip of dark bluish clay called Malm, Gault, or Black land, which is considered to rank among the finest in the country, but its area is very limited. The chalk hills, known as the North Downs, run through the middle of the county, and where there are deposits of gravel, loam and clay, there are some good farms, but where the chalk comes to the surface, as at Epsom and Banstead Downs, the land is uncultivated. Round Bagshot and Bisley are wide stretches of sandy and hungry soils, covered with heath or lying waste, which, whilst useless to the farmer, form the broad and picturesque common land for which Surrey is noted, and which, by their dry and healthy climate, as well as by their natural wild beauty, attract to their neighbourhood the well-to-do, who in their turn create markets for the produce of the small dairy farmers and gardeners, who locate themselves in the small patches of land that are capable of cultivation, but which are too small and scattered to form large farms.

The beauty of the scenery and its healthy climate make Surrey a resort for holiday-makers during the summer months. These visitors often find accommodation in cottages or farm-houses belonging to small holders, and thus help both to pay the rent and consume the produce. They often become regular purchasers of eggs, poultry and fruit, which are forwarded to them by rail or post.

Probably no other county of its size has more towns and localities of a residential character than Surrey, and these form centres for the sale of dairy, market garden, and other produce of the soil. On the other hand, the rapid growth of the residential areas increases the value of the land for building purposes, and where it is not immediately covered with bricks and mortar, it is placed beyond the means of the small holder by its increased value, and, pending its develop-

ment, can only be let for such short terms and on such insecure tenure as to make it practically useless to him.

The types of small holdings in the county, so far as they exist, may be classed under the three heads of Dairy, Market Garden, and mixed small farms.

Dairy Holdings.—The small holder, who depends on dairy produce for a living, and who devotes his whole energies to this particular branch, is to be found only in close proximity to the large towns and villages. These holdings chiefly exist where grass land is plentiful, as on the London Clay, particularly in the locality of Kingston and Malden. Many of these holders, more especially near the suburbs, have difficulty in obtaining a suitable farmhouse or homestead, and cows are therefore often housed in small dilapidated sheds adjoining their cottages on or near the land. In nearly all cases the holders are assisted by their families, supplemented by regular or casual hands, and milk is mostly sold retail. Poultry-keeping and butter-making are generally combined with the dairying, but the produce is largely consumed by the holders themselves.

Market-Gardening.—Small holders who devote themselves to market-gardening are probably the most successful. They are to be found in many parts of the county near the towns or within easy reach of the markets. The breaking up of large farms for building purposes often leaves suitable pieces of land, but such land is not generally provided with farm buildings, so that the holders are obliged to obtain a cottage to live in and erect such buildings as they may require. Near London the produce is usually sold locally, or in some cases sent to the large markets.

Mixed Small Farms.—About the heaths and commons in the western parts of the county there are many detached pieces of agricultural land from 10 to 50 acres in extent. These, from their size and situation, are unsuitable for the large farmer, and the soil is generally poor, but they have a cottage or farmhouse, and in some cases a homestead on them. Owing to the poorness of the soil, the persons who take these small farms generally have to supplement their incomes as farmers by working for others, or by combining other occupations with the cultivation of their holdings. Some have common

rights, and turn out cows or young stock on the neighbouring commons. They fatten the calves for market, and keep pigs and poultry. At the best, however, many of them make but a poor living.

Broadly speaking, all the holders are men with knowledge of the soil. They have been gardeners, nurserymen, farm labourers, bailiffs, or have followed the occupation of their fathers as farmers or small holders. The most skilled and intellectual are those who occupy the dairy and market-garden holdings. Many who lack the capital necessary to work a large farm, have enough to enable them to take 30 or 40 acres, but the majority have commenced life as farm labourers or have been connected with the soil in other ways, and by care and thrift have saved money. Some of these men have begun by taking an acre or two of land, which they have worked in their spare time, whilst engaged in other employments. They have gradually added piece by piece to their original holding, whilst giving less time to their other employments, until they find themselves in occupation of 30 or 40 acres, and able to support themselves and their families entirely on the land they have taken. Some instances may be given :—A man living on a holding in the east of Surrey, who was brought up on the soil, but followed the calling of a bricklayer. He hired 5 acres of grass land, keeping a cow and a few young stock. Having his family to assist him, he rented another few acres, until he became the occupier of 50 acres in three detached pieces. It has taken him twenty or thirty years to create this little farm, on one holding of which the landlord has built him a small cottage and farm buildings. At the present time he employs one regular hand at 20*s*. a week, whilst he works himself as a bricklayer for nine months of the year, at which he earns 35*s*. a week. He deals mostly in stock, and lives on the produce, selling the surplus.

A second instance is that of a man who started as a farm labourer, and having hired an acre or two of land, kept a few sheep, using his savings to buy sheep (from which he bred). He is now the owner of a breeding flock of 200 ewes, and has given up his employment as a labourer. At the present time he holds 30 or 40 acres of land, with a right to graze on the adjoining common.

A third case is that of a small holder, who, when sixty years of age, lost his employment as herdsman, when the herd of cows which he tended was sold. He had managed to save four or five hundred pounds, and after much searching for a suitable small holding in the district, found two or three pieces of land close to a large village in Surrey, with homestead and cottage. He bought the goodwill of a dairy connection and a small coal business from the outgoer, and at the present time one of his sons is managing the coal business, another son has charge of the milk-walk, and he and his wife work at home and attend to the stock, home and homestead. This they have done for the last five years, and appear to be thriving.

Five years ago, a man who had been a farm labourer for twenty or thirty years, earning fair wages, and saving out of them, started in a small way as a market gardener, taking 11 acres near the suburbs of London, at a rent of 56*s*. an acre. He devotes himself to market gardening, cultivating flowers, apparently, with much success. He sends his produce along with others to Covent Garden, where he either hires a stall or consigns his produce to the salesmen. He says his venture has been successful and his income greater than when he earned wages as a farm hand.

These are a few instances out of many, and show the way in which some small holders and holdings have originated in the county. Needless to say, many such have failed, either through want of capital, or knowledge, or from sheer misfortune.

The unsuitability for the small holders of the southern or Wealden district of Surrey, both on account of the nature of the soil, and the distance from good markets, has already been pointed out, but it is in this district, at Newdigate, a village between Holmwood and Redhill, that a colony of small holders has been established.

It is of interest both as an object lesson and as affording an example, and perhaps the only example in the county, of an organised attempt to solve, by private enterprise, the problem of rural depopulation, and for these reasons it deserves more than passing reference.

In the year 1902, an organisation was formed known as the

"Small Holdings Association," with the object of increasing the number of small working owners by the purchase of land in large areas and its sale in smaller lots. The keystone of the proposal as stated in the Company's prospectus, was the safe investment of the subscribed capital in land, and other real property, with a view to the sub-division and sale or hire of the estates acquired to carefully selected men upon conditions which, while providing them with liberal facilities for obtaining small holdings, will insure the shareholders a fair interest on their capital. Buyers were to pay down at least 10 per cent. of the purchase money, and the balance with interest, by half-yearly instalments. The Company undertook to provide roads and fences, and make other improvements, and to build houses for those who were prepared to deposit 25 per cent. of the cost and pay off the balance in the same way.

It was proposed to establish a system of co-operation, both in buying and selling. With these objects in view, the Company purchased at Newdigate a farm of 367 acres, known as the Cudworth Estate, at a price which, including a farm house and homestead, worked out at £12 5*s*. per acre, exclusive of the timber, valued at about £1,200, the tithe rent charge being about £32 per annum. After setting aside a sum for a reserve fund and payment of a cumulative dividend of 5 per cent. per annum, the balance of the net profits was to be applied for the benefit of the small holders, or to further in any other way the objects of the Company. Most of the land was sold during the first year or two in lots of from 1 to 30 acres in extent, to about 30 or 40 purchasers, at prices of from £25 to £30 an acre for sites having a frontage to the roads, and £13 per acre for some back land. Of the purchasers, the majority are men of middle age, who have been engaged in trade or business in London and elsewhere, and who for pleasure or health's sake, have been tempted to try a country life. The holdings are variously cultivated, and are used for growing market produce, nursery stock, fruit and flowers, for rearing poultry and other stock, which are mostly sold locally, or in Redhill and Reigate.

One of the most successful of the original holders occupying 30 acres devotes himself to dairy work, having

worked up a dairy connection, carting his milk for some miles round. Another grows produce for his shop in the suburbs of London. Another has a few cows, makes butter, has planted 3 acres with all kinds of fruit, and has an apiary of 27 bee-hives. Others have erected greenhouses, and go in largely for growing market-garden produce and fruit, which is sold to tradesmen in Redhill and Reigate. In one case, a holder has made small ponds and streams on his holding, and cultivates aquatic plants and rare fish with success.

There is an attempt amongst the most successful holders at co-operation on a small scale. One, for a commission, carts and sells the produce for his fellow-holders, to tradesmen in Redhill and Reigate twice a week. Another keeps two or three horses and a waggon, and has undertaken to cart, plough, and make hay for them, at low rates. Another keeps a cart and horse, and conveys his neighbours to Holmwood station for a small fixed charge. When any of them require extra labour, they usually engage the services of one or two of the other small holders for a small wage. One man has gone in for poultry keeping, and has 500 to 600 fowls, but finds the cold soil does not suit them. A large amount of the produce is consumed by the holders themselves. Those who have sunk much capital in the land in the way of improving the heavy soil, erecting greenhouses, planting fruit trees, and the growing of market garden produce, are probably doing best; and those who have used their holdings successfully for what they were intended, are mostly men with some previous knowledge of agriculture.

The general results of the undertaking seem to be:—(1) That some thirty or forty proprietors have taken the place of one farmer, who could not work the land at a profit. (2) That the new owners are, on the whole, healthy, and fairly prosperous. (3) That the shareholders may expect to receive back their capital intact, and have a surplus to spend on the estate in road-making or other improvements.

Some of the occupiers complain of the small return for their outlay, but speaking generally most of them seem so far contented with their venture.

OVERHEAD ELECTRICAL DISCHARGES AND PLANT GROWTH.

J. H. Priestley, B.Sc., F.L.S.
Department of Economic Biology, University of Bristol.

In giving a brief account of recent developments in this subject which show some likelihood of being of practical importance, I propose to refer chiefly to what would be called the practical side of the subject, the actual method of application of such discharge, and its effect upon the growing crop.

I have dealt elsewhere * with the historical side of the subject, and hope to do so at greater length at some future time, but on this occasion I would only refer to the pioneer work of Lemström which has been brought before the English-speaking public by the small book mentioned below.†

In Lemström's work the wires above the crop were charged with electricity by means of an influence machine specially designed for the work, and the method suffered from several defects in consequence.

It is difficult to get an influence machine to run satisfactorily when kept going continuously in the manner required in this work, and the quantity of electricity obtained from Lemström's machine was not sufficient to enable his overhead wires to be raised very high above the crop, on account of the fact that, if this were done, the discharge on to the plants would then cease. Consequently, in all his experiments, operations upon the growing crops were somewhat hampered by the wire network which impeded the men when trying to move among the plants.

In recent times it has been possible, owing to the use of Sir Oliver Lodge's high-tension valves in connection with a Ruhmkorf or induction coil, of a type similar to that used in X-ray work, to develop a method of generating continuous high-tension current which could be trusted to give a satisfactory output of current with only occasional attention, and

* Priestley, "The Effect of Electricity upon Plants," Bristol Naturalists' Society's *Proceedings*, Fourth Series, vol. i, part iii, 1907.

† Lemström, *Electricity in Agriculture and Horticulture.*—The "Electrician" Series.

with which, owing to the high tension reached, it was possible to have the discharge wires raised to a convenient height above the ground.

It is owing to the enterprise and energy of Mr. J. E. Newman that trials of the overhead discharge method upon a large scale have been carried out with these new facilities which, through the kind co-operation of Sir Oliver Lodge, F.R.S., and his son, Mr. Lionel Lodge, he has been able to test very fully.

These trials have been made chiefly upon the land of Mr. Raymond Bomford at Salford Priors, near Evesham. Mr. Bomford's co-operation has been of the greatest value to Mr. Newman. During the last year or two, also, a smaller but interesting trial has been made at Bitton, near Bristol, at some nurseries which are the property of Mr. George Newman. I have been privileged to be in close touch with these experiments throughout, and some description of their method and results may be of interest, particularly as they are now being taken up by other countries besides our own, and within a few years considerable data as to the advantages or otherwise of the method should be to hand. I propose to discuss first of all the general principles involved in installing an apparatus for producing electrical discharges upon crops, and then to discuss the more direct application of the method, first on open agricultural land and secondly upon greenhouse crops.

GENERAL PRINCIPLES.—It will be impossible to speak authoritatively upon this subject until infinitely more is known as to the physiological effect produced by the electrical discharge upon the plant.

Unfortunately my own work has been so interrupted by quite unavoidable causes that I do not feel myself in a position to discuss my experimental results, and the results of other investigations so far as published are very contradictory, and in any case have usually but little application to this particular method of electrification.

The general assumption underlying the work is evidently that the passage of a small electric current through the plant is beneficial to it, and tends to increase the yield and often to lessen the time in which that yield is usually obtainable.

Perhaps it would be more correct to say that the assumption is that *an increase* in the slight electric current passing in a plant is beneficial, because it must be remembered that in the ordinary way the atmosphere above a plant is usually at a higher potential than the plant, and as a consequence a slight current is probably leaking away to ground through the vegetation, and Mr. Newman has followed Lemström in usually having his overhead wires charged positively, and, therefore, practically increasing this current to the earth but not reversing its usual direction.

That this physiological effect is produced is still a subject open to controversy, and at present the most urgent need in connection with this subject is further experimental physiological work to decide the question. At present I think it is fair to say that the practical man may get as much guidance from the perusal of the results of field trials given at the end of this paper as from a *résumé* of the experimental results reported by various workers, and this is only another way of saying that the subject is still in the experimental stage. It is sufficient to say that electric currents are reported by many observers to have an optimal value for the plant they are traversing, an optimum which probably is variable for different plants and for the same plant at different times; and that up to this optimum, increase in the strength of the currents leads to increased growth, more rapid germination, increased storage of food and so on, but beyond this strength the current rather inhibits vital activities and tends to lower the resultant yield from the plant.

My own experiments upon the respiration of electrified plants lead me to attach more importance than is usually done to a possible accelerating action of the current. A study of field experiments shows that often an acceleration is reported, and this acceleration may have a very important bearing upon the yield of the crop; the results seem to me to need analysis from this point of view. Thus, an increased yield may in some cases be largely due to the fact that the crop was spared bad weather owing to its more rapid development, and was, therefore, harvested under better conditions.

This acceleration effect seems to be only one indication of many, pointing to a raised vitality in the plant, as evinced by a more active pursuance of its normal physiological functions.

Thus several experiments point to the fact that the electrified plants give off water more rapidly, and as a consequence may suffer, as compared with their unelectrified fellows, if too strongly electrified during a dry season. This seems to me the most probable cause of the smaller strawberry crop, accompanied by a much sweeter if, on the average, smaller fruit, from the Evesham fields, in 1908. (See page 28.)

It is well known nowadays that the disease-resisting power of a plant seems largely a function of its vitality, and when grown under unsuitable conditions the less virile plants seem more easily to succumb to the parasitic attack. It is hence, perhaps, worthy of note that on one or two occasions in the cucumber houses at Bitton, electrified houses seem to have shown indication of greater resistance both to the ordinary Cercospora spot disease and to other occasional outbreaks of disease. From the nature of the trials, however, I fear no very definite statement is possible, and the question is not easily decided by experiments in the laboratory.

Various workers have reported increased chemical activity in the plant under electrification, particularly Pollacci, who reports that the manufacture of carbohydrates from atmospheric carbon dioxide is possible in leaves, with an electric current traversing them, at light intensities too feeble to admit of such synthesis without the current.

Such a conclusion points to the application of the current at times near the hours of sunset and sunrise; in many of the practical trials in this country some such hours have been employed, without, however, the effect being markedly more beneficial than in trials when the current has been applied at other hours.

The numerous experiments of Berthelot reported in the first volume of his "Chemie Végétale et Agricole" also seem to suggest that the electrified plant may be capable of increased chemical activity, and perhaps along unusual lines,

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particularly in the direction of direct utilisation of atmospheric nitrogen. These are clearly points of very great importance, only to be settled finally by careful quantitative work in the laboratory.

Other general points need a very brief mention, in particular the possibility of changes in the atmosphere and soil surrounding the plant as a result of the discharge. It is, of course, well known that the electrical discharges in thunder weather bring about a combination of the oxygen and nitrogen in the air, that the products of this combination are carried to the earth in the rain, and that thus every year small quantities of nitrate are added to the soil. It is also a well-established fact that the silent discharges of electricity, as they are called, as in the case of the quiet continuous discharge from the overhead wires in these large scale experiments, are capable of bringing about chemical combinations, and thus the result of having such a discharge above the plant might be expected to be a very slight but *continuous* addition of nitrate to the soil around the roots.

Many of the observers of the electrified crops have suggested this explanation, on account of the darker green colour of the foliage as compared with the control plants. This feature has been very noticeable in the wheat experiments on two occasions.

At the same time, it should be pointed out that in chemical combinations between gases under point discharge, which should be a fairly comparable case, it is always stated that most combination is produced with the point (equivalent to the overhead wire) charged negatively, and this does not agree with Mr. Newman's statement that the overhead system is of most practical value when charged positively.

Finally, it must not be forgotten that bacterial activities within the soil and the interchange going on between root and soil, are both important factors in the plant economy, liable to undergo a definite change under these conditions. What direction those changes might be likely to take is too speculative a subject to consider here and must await full experimental investigation.

APPLICATION OF THE METHOD OF OVERHEAD DISCHARGE.

A. In the Open.—In considering the method of applying the overhead discharge it should be clear that many points in regard to its use are at present not decided, and that any rules followed in regard to times of electrification, strength of current, &c., are of an empirical character.

The system is capable of use upon a large scale, and the Evesham installation charges some twenty acres; similar installations could easily be established to charge a still larger area, and a device which would be quite possible is to charge at alternate periods in the 24 hours two different areas of some twenty acres each. The first necessity is a supply of current for the induction coil. Continuous current, any voltage from 10–250 and at about 100–500 watts is necessary; current at 110 volts and 2–5 amperes is quite satisfactory. If this is not available from some power station in the neighbourhood it can be generated by means of a dynamo and small oil engine, which can be placed upon any convenient spot upon the farm, and the power may probably also be employed for other purposes. The high-tension generating apparatus needs to be placed in a building—a watertight shed will do—near the area to be electrified, as, while it is possible to lead the lower-tension current any distance without appreciable loss by leakage, this is not the case with the high-voltage current. The high-tension apparatus can hardly be satisfactorily described in a non-technical article; Sir Oliver Lodge has briefly described it in a paper published privately in 1908, but anyone thinking of adopting the system would need to consult Sir Oliver Lodge, Mr. Newman, or other electrical expert, unless he is himself acquainted with the working of the mercury break and high-tension coil, the Lodge electrical valve, &c., while much of the apparatus is protected by patents.

Suffice it to say that the whole apparatus is very compact and could easily be stored in a small shed, and when once in good running order requires surprisingly little attention, and as the necessary manipulation to start and stop the discharge is confined to moving a few switches and testing the strength of the discharge by measuring the distance the

spark will leap over a graduated spark gap, the whole matter should take but a very small proportion of time.

Occasional overhauling of the apparatus from time to time by an expert electrician seems to me, from my experience with the Bitton apparatus, a very desirable precaution, as otherwise valves are likely to be overstrained and consequently finally break down.

Presumably, however, the tendency will be, with time and more experience, to render the apparatus more and more what the modern motor-car is sometimes described as being, viz., "fool-proof," or, in other words, capable of complete control by non-experts.

By means of the high-tension apparatus the current is raised to a very high voltage; something like 100,000 volts is the usual figure, and now great precautions have to be taken to prevent unintended leakage and consequently, such a decrease in the voltage that the current no longer discharges upon the proper area. To avoid this the current is carried by thick telegraph wire—the thicker the wire the less the chance of leakage into the air—borne upon insulators raised some 16 feet above the ground by means of larch poles, the poles being planted firmly, when possible by the hedges, but of necessity in large fields, some in the open field.

By judicious arrangement the network of wire necessary to charge twenty acres can be carried by some 20 poles. The insulators have to be of a special type to prevent as far as possible leakage down the pole, which is likely to occur in spite of the fact that the charged wire never touches the insulator or pole, but is fastened to it through the agency of yet another insulator and a short piece of wire.

Serious leakage in wet weather and for some hours subsequent to rain can probably never be prevented, but it is certain that, with the devices now adopted by Mr. Newman and with a new form of insulator now in use at Evesham, given dry conditions, the discharge takes place from the part of the overhead system intended for the purpose. This discharge area consists simply of a series of thinner wires stretched taut between two of the parallel thick wires. With lower voltage it would probably be necessary to supply downwardly directed points at intervals along the discharge

wires, but with this high voltage it is possible without this provision to detect a quite appreciable discharge from the wires when the apparatus is running properly.

It is, of course, very necessary to have some simple method of ascertaining that effective discharge is really occurring.

The arrangement adopted is to have an insulated wire which receives a charge when the overhead wire is giving off electricity, and this charge can be detected quite simply, either by touching the wire with the finger, when a slight shock is felt as the current passes through one's body to the earth. At night a different method may be adopted; a vacuum tube, which will show a bright glow as the slight current passes, may be used.

Using this method it is possible to test to what extent the wires are distributing the charge over the field, and hence at what distance apart they may be effectively put, a distance that varies with height of crop and of the wires above the ground.

It can also be shown that the treated area will not be sharply delimited from the untreated if growing side by side, for it is found that on windy days the discharge is carried considerably further over the crop in the direction in which the wind is blowing.

As it is possible by the method described to detect quite close to the ground an appreciable discharge from a wire raised some 10–16 feet above it, it is clear that this height is preferable, as it permits of all the ordinary operations of cultivation, including harvesting, being carried on without interference and without damage to the overhead system.

Thus Mr. Newman tells me that, in the three years' work at Evesham, only one wire has been broken.

As to the results of the treatment given under these conditions, probably most readers will be accustomed to large scale trials, as for instance with manure, and will be able to form their own conclusions from the table given at the end of this article.

For my own part I consider they give justification for the verdict that the method is worthy of further trial.

B. Under Glass.—Under these conditions it is possible either (1) to use a smaller and cheaper method of generating

electrical discharge, the influence machine, with, however, the attendant disadvantages of smaller output and liability to interruption owing to the unsuitability of most forms of influence machines for continuous running, or (2) to adopt the high-tension system described for work in the open.

Along the first lines ran the early experiments at Mr. Newman's nurseries at Bitton, and with remarkably good results on the whole, the occasional failure being probably to be attributed to causes which could easily be controlled. If anyone is desirous of attempting this method, any friend conversant with electricity, and in particular with influence machines, could probably supply the necessary information for installing such an apparatus. Experience would soon show the most practicable method of working, precautions being taken, as suggested in the previous section, to see that an effective discharge is being obtained.

In my own experiments with plants growing under glass under wires charged from an influence machine, I have always found it necessary, to ensure a good discharge, to have downwardly directed points, formed of the free ends of short lengths of fine wire twisted around the stouter wire carrying the charge.

In applying the other method in use at Evesham to work under glass, several points had to be considered. The main difficulty was the great tendency to leakage under these conditions, and in practice it was never possible to keep up such a high charge on the wires running through the greenhouse, as, with the same apparatus, could be obtained in the open field. At the same time it was quite possible to keep up an effective discharge, Mr. Newman and myself testing the point on several occasions by carrying a long test wire into the houses and testing the distribution of the charge.

To avoid leakage where the current entered the house, a pent roof was put up to prevent the water dripping on to the insulators used, and under this pent roof was placed, first a large porous cylinder or perhaps an ebonite tube, and within this a tube of fused silica, some two feet long, through which the charged wire (gutta-percha covered wire) ran. These fused quartz or silica tubes are easily obtainable nowadays, and seem the most satisfactory type of insulator.

Within the house, the wire was simply hooked on to another wire, running the whole length of the house, and supported by ebonite insulators attached to either door by lengths of paraffined string running through holes in an ebonite rod. This single wire was of comparatively small diameter and acted as the discharge wire.

The houses are arranged in groups of five, without walled partitions separating them, and hence it was possible to run the charge from house to house within the same block by simply carrying a wire under the wooden frame supporting the glass roof, the wire being passed through a long cylinder of porous earthenware that was suspended freely from the roof by means of paraffined string.

Under these conditions the discharge was obtained, but from the construction of the houses it is certain that a very large percentage of the charge must be lost.

Thus the hot-water pipes are raised well above the floor, and the base of the plants may be described as being in the "shade" of these iron pipes as regards effective discharge, as the plants are not raised upon staging above the hot-water pipes. Cucumbers and tomatoes are the crops usually grown, and while the tomatoes may obtain their fair share of the charge, the cucumbers, in their attempt to obtain light, spread their leaves and stems so close to the glass that they run within the protection of uninsulated wires, placed near the roof to afford them support, and to which their tendrils cling. To such extent as they lie behind these wires they must be very much out of the region of discharge, and it does not seem to me surprising that the results for 1908 with cucumbers grown in this manner show very little difference that can be attributed to the current. And yet even in this case the acceleration results are quite striking, as is shown by the table appended of the cucumbers cut from five of the houses in April, 1908.

Another difficulty that has to be met in installation under glass is the added risk of shock to those working amongst the crops. Cultivation under forcing conditions involves almost continuous attention being paid to the plants, and as a consequence arrangements have to be made to allow men to work amongst the crops without the

risk of a shock, which would be sufficiently violent to be a considerable inconvenience. This result may be achieved by running the electrical discharge only at night. At Bitton this practice has usually been followed, the wires through the greenhouses being charged at night and an area out of doors electrified during the daytime; unfortunately there are not sufficient physiological data to hand to say whether current applied at such a time is effective or not. If, however, it is desired to run the apparatus in the daytime, this may quite easily be done, because the wires are so arranged that, in those houses in which the doors open inwards, the wire is attached to the door, and as the door opens the wire sags until it reaches the ground and is thus discharged.

The spark passing between the wire and the ground is quite audible, and warns the person entering that if he closes the door behind him he will be liable to receive a shock from the wire, once more insulated and charged. In those houses in which the door opens outward, Mr. Newman has attached the wires to the door by means of a simple device, which renders it impossible to open the door until the wire has been slackened and lowered to the ground and thus discharged.

Apart from such additional problems as these, the question of electrifying greenhouse crops is essentially similar in its nature to that of treating areas out of doors, and this has already been discussed. I only desire, in conclusion, to point out one further difference that may be of great importance.

In greenhouse work the plants are usually being forced by the use of higher temperatures, and their physiological functions must already be proceeding at a rate that is greater than for plants in the open, and this may possibly have some bearing upon the results produced by electrification.

Can acceleration still be produced by the current, when vital functions are already proceeding at a rapid pace?

The results previously referred to seem to answer in the affirmative, but careful analysis of further results obtained under glass is desirable before any definite statement is made. Apart from this point, with work in the open in this country it seems probable that temperature must so often be the factor which limits the activity of plant processes, that when this

check is removed, one might expect to see a greater response to the stimulating action of the current, expressed, perhaps, in greater synthesis of foodstuff, more rapid evaporation of water, and so on.

COST OF TREATMENT.—The practical man will probably desire that this article should include a reference to the cost of this new method of treatment, but that is a subject which I do not feel competent to pursue in any detail.

Presumably any person desirous of installing such an apparatus would first get in touch with some competent firm of electricians, and thus he could soon get some idea of the cost. The Agricultural Electric Discharge Co. would possess all necessary data on these points. From my own experience I am satisfied that an apparatus for greenhouse work, in which the electricity is supplied from a continuously running influence machine, could be installed at a cost of some £50; but the other and more satisfactory method, which is the only one which at present seems to admit of development upon a large scale, would cost considerably more, perhaps some £200 to £300. When once installed the cost of running resolves itself practically into a question of the cost of working an ordinary gas or oil motor, with an occasional need for resting or replacing an overstrained electric valve.

Results of Large-Scale Experimental Trials.

Bitton, 1905.

(Electricity from an influence machine.)

Cucumbers.—Increase 17 per cent.
Strawberries (5-year plants).—Increase 36 per cent. (1-year plants).—80 per cent. (and many more runners produced).
Broadbeans.—Decrease 15 per cent. Acceleration—some 5 days.
Cabbages (not weighed.) Acceleration—10 days.
Celery.—Increase 2 per cent. Wires used as discharge points not fine enough.
Tomatoes.—No difference.

Gloucester, 1905.

(Electricity from an influence machine.)

Beets.—Increase 33 per cent. *Carrots.*—Increase 50 per cent.	Both electrified and control areas watered in dry weather.

Evesham, 1906.

High-Tension Electricity from Coil and Valves, &c.

Wheat Canadian Red Fife.—Increase 39 per cent. English Red Queen.—Increase 29 per cent.

Barley (a very irregular crop, owing probably to previous treatment of field).—Increase 5 per cent.

Evesham, 1907.

Wheat Red Fife.—Electrified, 41·4 bushels per acre; control, 32·0 bushels per acre. Increase 29 per cent.

Mangolds.—Some 18 per cent. increase; but estimation merely by cartloads, and as loads varied, being biggest where crop heaviest, real increase should be greater.

Strawberries.—First complete picking, June 28th. Electrified 56 lb.; control, 33 lb. (Area of electrified is only 56 per cent. size of control area.) Final difference, July 10th.—Increase 25 per cent.

Evesham, 1908.

Strawberries.—Acceleration as previously, thus:—Pickings on June 20th and 22nd give electrified 1,318 lb.; control 1,876 lb. (Electrified area 56 per cent. size of control.) Final result.—Decrease 9 per cent. (July 8th). Dry season.

Wheat.—Electrified (7·68 acres) 32·5 bushels per acre; control (10·2 acres) 26·15 bushels per acre; increase, 24·3 per cent.

Tomatoes.—Variety Bryant's Special (grown to single stem).

	Electrified. A	*Electrified.* B	*Control.*
Number of Plants	483	929	148
Total fruit picked (lb.)	1,390	3,175	358
Lb. per plant	2·9	3·5	2·4
Fruit picked ripe and sound before Sept. 24th	175	333	15

The control area and electrified area A were to all appearances exactly comparable as to situation and soil, while area B had a somewhat better aspect and was occasionally irrigated by the overflow of a pond.

Bitton, 1908.

High-Tension Electricity from Coil and Valves, &c.

Cucumbers.—

			Numbers picked before April 29th.
Set of 5 houses	(1) control ...	2,410 cucumbers ...	(1) 214 cucumbers.
	(2) control ...	2,477 „ ...	(2) 343 „
	(3) electrified ...	2,753 „ ...	(3) 485 „
	(4) electrified ...	2,710 „ ...	(4) 487 „
	(5) electrified ...	2,729 „ ...	(5) 424 „

POULTRY FATTENING CENTRES.

J. W. HURST.

The economic advantage, to both producer and consumer, of properly fattened fowls is a matter regarding which there can be no dispute; but the fact remains that the demand is limited to certain markets, and production is at present only remunerative in a few districts. The annual loss entailed by the premature killing of lean fowls cannot be estimated, but it must be very considerable.

The eighth annual report of the Department of Agriculture and Technical Instruction for Ireland contains a pertinent remark, based upon Departmental experience, to the effect that "a station cannot be established successfully unless adequate supplies of suitable birds, as well as the necessary feeding stuffs, are readily available in its neighbourhood. Highly efficient management is also an indispensable condition for success."

Supply of Birds for a Fattening Centre.—The question of adequate supplies is of primary importance in the establishment of a fattening centre, and it is in connection with this initial requirement that co-operation and organisation are so essential. Large numbers of the birds used in existing centres bear the burden of double carriage—both as lean and dead fowls—an addition to the cost of production which could be minimised by an increased number of centres. These would reduce the distance from which the supplies would be drawn and increase the incentive to breed more extensively. Leaving the Irish supply of fowls for the Sussex fattening centres out of the question, there are a number of districts in England and Wales whence considerable quantities of lean chickens are also sent, and where the breeders are numerous enough to form the nucleus around which others would spring up if a practical scheme of fattening centres could be formulated. It would, however, obviously be useless to open up an establishment in even the most favourable locality without first arriving at some agreement with the principal breeders within a reasonable area, because only by a successful commencement could others be induced to appreciate the benefits of such a combined effort. It re-

quires a strong incentive to induce farm poultry rearers, who form the backbone of the supply, to depart from old methods; and only when a local object-lesson assures them of an increased profit will the great majority make any change.

The existing fattening centres of Surrey and Sussex have grown through a succession of generations, and now benefit by the advantages that have accumulated in the past; and it is the lack of this combination of favourable factors that militates against the success of the majority of new ventures. New fattening centres must, as far as possible, commence with the necessary combination of advantageous circumstances. Modern conditions do not allow a waiting margin, but once a reasonably constant and sufficient supply of lean birds can be depended upon, the chief disability is removed.

The difficulty does not lie so much in the quality of the supply as the quantity. English farmers of the present day understand the requirements for table poultry much more generally than was once the case, and any levelling up in quality would be easily and quickly effected through the agency of those locally responsible for the fattening. The crux of the matter is the adequacy of the supply as regards quantity, and this will probably never be secured until the fattening centre in any district is an accomplished fact. Sufficient numbers of fowls for the purpose will never be reared until the collector and the improved price are in evidence, or at least until some understanding between rearers and fatteners gives promise for the future.

Local Supply of Feeding-stuffs.—The suitability of the feeding-stuffs that may be locally procurable involves questions of milling and carriage that require careful consideration, because in many cases the products of the mills in an otherwise favourable locality are not the best possible for the purpose, and the addition of the cost of carriage to a really desirable meal prepared at a distance is often prohibitive. Although theoretically other preparations may appear of almost equal value for fattening, it is a matter of everyday practical experience that Sussex ground oats give the best results, a fact that is due to the presence of a greater proportion of the grain and husk in a digestible form than is

possible by any other process. In the matter of railway charges, a fattening centre worked upon co-operative lines would naturally be in a better position than a small user; although it must be remembered that the consignments would require to be frequent rather than large, as the quality of the meal deteriorates by storing. Sussex ground oats can, however, be produced elsewhere than in Sussex, and with a good local demand a miller might be inclined to set up the necessary stones. The peculiar dressing of the stones requires, however, special skill, and is a slow and, consequently, expensive process. It would not, therefore, be sufficiently remunerative, from the miller's point of view, if the demand were relatively small.

One great drawback to the establishment of additional fattening centres appears, therefore, to consist in the fact that in many cases more or less inferior feeding-stuffs would have to be employed, or carriage added to already high-priced meals.

Cost of Carriage.—Another reason why fattening is not more largely undertaken by individual producers is the lack of railway facilities and the high cost of carriage, the charges being in so many cases out of all proportion to the value of the produce. This difficulty would be to some extent removed by combining a number of lots in one consignment and by regularity of output. Railway companies are usually willing to meet representatives from organisations of traders if some definite guarantee can be given.

Labour.—The employment of skilled labour is essential, and although higher wages have to be paid, it is only by employing such men that the cost of production is minimised, and the maximum returns secured. Apart from proficiency in the mere mechanical work of cramming, a considerable part of a fattener's skill consists in the knowledge of conditions of "ripeness" in the individual fowl. The difference between the amateur and the professional is shown more particularly in this detail than in any other—the former has one rule (of time) for all, whereas the latter recognises the fact that fowls show individuality in fattening capacity. It is remunerative to feed some beyond the usual period, and it is wasteful to keep others in the coops for the normal

number of days; and the skill which discriminates in such matters is a valuable asset. The supply of skilled labour is at present limited, and drawn almost entirely from the Sussex fattening districts; but experience shows that the supply of skilled labour tends to increase with permanence of demand and adequacy of wages. It is therefore reasonable to assume that the establishment of additional fattening centres would produce the necessary supply of labour.

Demand for Produce.—Finally there is the question of the demand for fattened fowls. Whilst it is true that fattened poultry is more economical than unfattened, for the consumer as well as for the producer, the great mass of consumers do not understand that the increased proportion of flesh is cheap at the extra price. The increase of fattening centres would therefore need to be gradual and not out of proportion to the demand. But apart from the steady demand of the metropolitan markets, there are indications of a more widespread appreciation in the provinces of well-fattened fowls of fine quality. (Detailed information as to the character of the demand in the chief provincial markets was given in this *Journal*, February and May, 1908.)

NOTES ON THE TIME OF BLOSSOMING OF FRUIT TREES.

CECIL H. HOOPER, M.R.A.C.

With the object of checking the observations * made in 1908 on the order of flowering of different varieties of hardy fruits, records were again kept in the fruit plantations of the Wye Agricultural College, Kent. Similar records have also been supplied to me from Worcester, Hereford, Monmouth, Sussex, and Kent.

The weather during the time of blossoming in 1909 was favourable for fruits generally. On the nights of April 30th and May 1st there was slight frost, with a little snow and hail, but, the weather and the plants being dry, little harm was done to gooseberries, red currants and black currants, which were in flower at the time.

Cob nuts were in flower at Wye from February 1st to

* *Journal*, December, 1908, p. 678.

April 3rd, and were subjected to considerable snow and frost; the crop was, however, good.

Gooseberries were in flower from April 19th to May 6th, being in full flower about April 27th. Picking "green" began on May 25th, the fruit being rather larger than at the same date last year, but the crop was not so heavy.

Red currants were in flower from April 19th to May 21st, being in full flower about April 29th; the crop was very good; picking began on July 12th.

Black currants were in flower from April 19th to May 21st, being in full flower about May 7th; the crop was about half a full crop; picking began on July 4th.

Plums were in flower, commencing with the Japanese, from April 19th, and the European from April 22nd to May 16th. In 1908 the European varieties commenced to flower on April 21st, and continued in flower to May 20th.

In order to ascertain the comparative order of flowering of the different varieties, I have taken an average from my records at Wye for 1908 and 1909, from the ten years' record (1888 to 1898) of Mr. John Watkins, of Hereford, from the eleven years' record (1898–1909) of Mr. H. B. Pollard, of Evesham, and from that of Mr. W. Hooper, of Sutton, Surrey, for 1909; the following appears to be the approximate order of flowering:—

Early Bloomers.—(1) The Japanese plums, (2) Grand Duke, (3) Damascene, (4) Black Diamond, (5) Prince of Wales, (6) Monarch, (7) Rivers' Early Prolific, (8) Greengage, (9) Victoria, (10) Drooper, (11) Pershore egg plum.

Late Bloomers.—(12) Bradley's King of Damsons, (13) Sultan, (14) Oullins golden gage, (15) Jefferson, (16) Farleigh Damson, (17) Cox's Emperor, (18) Coe's Golden Drop, (19) Prune Damson, (20) White Bullace, (21) Pond's Seedling, (22) Late Orleans, (23) Belle de Louvain.

Of these some vary in their order of blossoming, notably Victoria; among those constantly early may be mentioned the Japanese plums, Grand Duke, Damascene, and Black Diamond, whilst among the latest to flower in all records are Coe's Golden Drop and Pond's Seedling.

Of the eight varieties for which a full record was kept in 1909 at Wye, the average duration of flowering was 18 days. Most of the trees were in full flower on the seventh day after commencing to flower. In 1908 the average duration of flowering of ten varieties was 17 days. As the total flowering

period of the different varieties of plums is about 25 days at Wye, and probably about the same in other parts of England, both the earliest and latest flowering varieties have a considerable portion of their flowering time during the period when other varieties are in flower, so that there is probably no difficulty in fertilisation. The late Mr. John Watkins, of Hereford,* who has kept records of the flowering of fruit-trees for a considerable number of years, wrote that in the different seasons he had found a range of 40 days in the time of plums commencing to flower, the earliest being March 19th, the latest April 28th. He thought that plums crop best in late seasons, and that early varieties crop best if growing in a high situation where they escape the early spring frosts. He remarked that nearly all the late dark plums, such as Grand Duke and Black Diamond, blossom early; also that the capability of cropping and time of ripening of a variety are independent of whether the variety flowers early or late, these qualities being characteristic of the variety itself.

The crop of plums at Wye in 1909 was not so heavy as in 1908. Owing to lack of sunshine the fruit was dull in colour and lacking in flavour; damsons, however, were a plentiful crop.

Cherries.—These were in flower at Wye from April 21st to May 19th. The crop was exceptionally heavy.

In 1909 the different varieties of cherries were in flower an average of 22 days, and were in full flower about the seventh or eighth day after commencing to flower. Cherries of different varieties come into flower at very nearly the same time, excluding Morello, which is always the latest to flower. The earliest and latest flowering cherries had fifteen days of simultaneous flowering. The fact of the different varieties being in flower at the same time must assist in fertilisation.

The mean order of flowering observed by Mr. F. Ivo Neame at Faversham, Mr. J. Watkins at Hereford, and Mr. W. Hooper in Surrey, is as follows:—

(1) Caroons, (2) Rivers' Early Black, (3) Elton, (4) Black Eagle, (5) Knight's Early Black, (6) Governor Wood, (7) Turk, (8) Bigarreau Napoleon, (9) Rivers' Bigarreau, (10) Waterloo, (11) Florence, (12) May Duke, (13) Morello.

* *Year-book of the Herefordshire Association of Fruit Growers and Horticulturists,* quoted in "The Fruit Grower," July 8, 1909.

Pears.—These were in flower at Wye in 1909 from April 26th to May 18th, some late flowers lasting till June 1st. The crop was only moderate. The average duration of flowering of 15 varieties was about 14½ days; in 1908 it was 17 days. The trees were in full bloom about the seventh day after commencing to flower.

The approximate order of flowering taken from seven records, viz., at Wye in 1908 and 1909; by Mr. F. Ivo Neame at Faversham in 1907, 1908, and 1909; Mr. J. Watkins, of Hereford, and Mr. F. J. Chittenden, Royal Horticultural Society's Gardens, Wisley, in 1908, is as follows:—

(1) Beurré Hardy, (2) Duchesse d'Angoulême, (3) Beurré Clairgeau, (4) Beurré Diel, (5) Beurré Bosc, (6) Marguerite Marrillat, (7) Beurré Superfin, (8) Williams' Bon Chrétien, (9) Durondeau, (10) Jargonelle, Pitmaston Duchess, (12) Catillac, Louise Bonne of Jersey, Souvenir du Congrès, Clapp's Favourite, (13) Doyenné Boussock, (14) Dr. Jules Guyot, Beurré Giffard, (15) Doyenné du Comice, (16) Marie Louise d'Uccle.

In pears generally the varieties keep to a definite order of flowering, though some varieties are more constant than others. Of the kinds which flower early may be mentioned Beurré Hardy, Duchesse d'Angoulême, Beurré Clairgeau; whilst Marie Louise d'Uccle, Clapp's Favourite, and Doyenné du Comice appear to be always among the latest to flower. Williams' Bon Chrétien appears to vary somewhat in its time of flowering relatively to other varieties.

The average length of time pears were in flower in 1907 was 17⅗ days, being in full flower on 4¼ days; in 1908, 15 days, being in full flower on 4¼ days; in 1909, 18 days, being in full flower on the seventh day.

From experiments in America, and also in England,* it has been shown that many varieties of pear are self-sterile, *i.e.*, the flowers need the pollen of another variety to fertilise them; it would seem to be advisable, therefore, to intermix different varieties in an orchard, rather than to have a very large number of one variety; it may also be advisable to note, in planting pears, whether the variety is early or late blooming, and plant some trees of a different variety that flowers at the same time so as to insure pollination as completely as possible.

* Investigations by Mr. F. J. Chittenden, F.L.S., *Royal Horticultural Society's Journal*, xxvii, page cxc, and xxviii, page clxvi.

Beurré Clairgeau, Pitmaston Duchess, Catillac, Marie Louise d'Uccle, Clapp's Favourite, and Doyenné du Comice all appear to be good pollen producers.

Apples.—I have had the opportunity of examining 26 records * of the order of blossoming of different varieties of apples, and from these the average order of blossoming of the following varieties has been worked out:—

Average order of commencement of blossoming of different varieties of Apples, from 26 records in various parts of England and during several years, with dates for 1909.

Early Flowering Apples.

May 6th.—Irish Peach.

May 7th.—Duchess of Oldenburgh, Cornish Aromatic, Early Peach, Red Astrachan, Yellow Ingestre, Golden Spire, Maltster.

May 8th.—Warner's King, Keswick Codlin, Brownlees's Russett, Tower of Glamis, Devonshire Quarrenden, Pearson's Plate, Prince Bismarck, White Transparent.

May 9th.—Braddick's Nonpareil, Washington, Royal Snow, Beauty of Bath, Ribston Pippin, Christmas Pearmain, Gravenstein, Domino, Fearn's Pippin, Early Julian.

May 10th.—Rosemary Russett, Kerry Pippin, Margil, King Harry, Wealthy, Twenty Ounce, Egremont Russett, Dutch Mignonne, Stirling Castle, Adams's Pearmain, Beauty of Kent, Saltmarsh's Queen, Allington Pippin, Sturmer Pippin, Lord Suffield.

Mid-Season Flowering Apples.

May 11th.—Hoary Morning, Worcester Pearmain, Charles Ross, Scarlet Nonpareil, Mr. Gladstone, Early Rivers, James Grieve, Claygate Pearmain, Allen's Everlasting, Potts' Seedling, Bau-

* The observations do not tally so well as an observer would like to see; at the same time the general order of flowering is noticeable in every set of observations. The information is summarised from observations made by the following gentlemen:—

Mr. John Watkins of Herefordshire for 1894.
Mr. Spencer Pickering, F.R.S., Woburn Experimental Fruit Farm. 1905 to 1909 on Paradise and Crab stocks.
Mr. B. T. P. Barker, M.A., National Fruit and Cider Institute, near Bristol. 1908 and 1909.
Mr. Edward A. Bunyard, Royal Nurseries, Maidstone. 1908.
Mr. Fred. Ivo Neame, Macknade, Faversham. 1907–8 and 1909
Mr. W. E. Bear, Magham Down, Sussex. 1909.
Mr. Walter A. Voss, F.C.S., Rayleigh, Essex. 1909.
Mr. F J. Chittenden, Royal Horticultural Society's Gardens, Wisley. 1908.
Mr. Geoffrey F. Hooper, Pershore, Worcestershire. 1909.
Mr. R. M. Bannerman, Ross, Hereford. 1909.
Rev. J. Bernard-Hall, R.N., Corbridge, Northumberland, 1908.
Mr. William Hooper, Sutton, Surrey. 1909.
Mr. F. Lonsdell, Desford, Leicester, 1909, on Free and Paradise stocks.
Mr. Cecil H. Hooper, Wye, Kent. 1908 and 1909.

mann's Red Winter Reinette, Bramley's Seedling, Lord Grosvenor, Ecklinville Seedling, Peasgood's Nonsuch, Calville Malingre, King of the Pippins, Byford Wonder.

May 12th.—Cox's Orange Pippin, Frogmore Prolific, Colonel Vaughan, Hormead's Pearmain, Tom Putt, Newton Wonder, Roundway's Magnum Bonum, Mère de Ménage, Tyler's Kernel, Wellington, Blenheim Orange, Duchess' Favourite, Alfriston.

May 13th.—Gloria Mundi, Old Hawthornden, Cox's Pomona, Winter Quoining, Round Winter Nonsuch, Lord Derby, Baxter's Pearmain, Seaton House, Lane's Prince Albert, D'Arcy Spice.

Late Flowering Apples.

May 14th.—Belle de Pontoise, Reinette du Canada, American Mother, Grenadier, Gold Medal, Golden Noble, Annie Elizabeth, Loddington or Stone's Apple, Northern Greening, Cellini, Lady Sudeley, Lady Henniker.

May 15th.—Foster's Seedling, Gascoyne's Scarlet.

May 16th.—Yorkshire Beauty.

May 18th.—Sandringham.

May 19th.—Graham's Royal Jubilee.

May 21st.—Calville Rouge Précoce, Court-Pendû-Plat.

Duration of Blossoming of Apples and time taken to come to full bloom.—In 1908, at Wye, the average length of time in flower of some 70 varieties of apple was 15 days, and they were in full bloom about the sixth day after commencing to flower.

In 1909 the following records were obtained:—

Observer.	County.	Number of Varieties.	Length of Time in Bloom.	Full Bloom.
R. M. Bannerman	Hereford ...	33	13 days	6th day.
W. A. Voss	Essex ...	22	nearly 17 ,,	7th ,,
F. I. Neame	Kent ...	16	nearly 17 ,,	10th ,,
C. H. Hooper	Kent ...	59	nearly 18 ,,	8th ,,

Of the apples long in flower this year at Wye may be mentioned New Hawthornden, in flower 20 days; Hoary Morning, 20 days; Ribston Pippin, 21 days; Bismarck, 21 days; Graham's Jubilee, 21 days; Golden Noble, 21 days; Baumann's red winter Reinette, 22 days; Wellington, 23 days; Newton Wonder, 23 days; Lane's Prince Albert, 22 to 26 days.

Strawberries in 1909 commenced to flower at Wye on May 9th, were generally in full flower May 22nd to 25th, remaining in flower up to about July 6th. Picking in quantity began on June 21st. The crop was exceptionally heavy, due to rain, but the fruit had less flavour than usual.

Raspberries commenced to flower May 24th, were in full flower on June 3rd, and finished flowering about July 6th. Picking began on July 14th. The crop was not good, much being spoilt by excess of rain and deficiency of sunshine.

CORN COCKLE.

(*Agrostemma Githago,* L. = *Lychnis Githago,* Scop. et Lam. = *Githago segetum,* Desf.)

Description.—A weed of cornfields which is of considerable importance to the farmer is that known as Corn Cockle, Corn Campion, or Purple Cockle, and also as Bastard Nigella, and Wild Savager. It occurs on sandy, loamy, or clay soils, and is a common weed. Fream says its presence indicates a poor soil or neglect in cultivation.

Corn cockle (see Fig.) is a handsome, erect plant, 2 to 4 feet in height, and covered with smooth white hairs. The straight leaves are up to 5 inches long, narrowly lanceolate, and placed opposite one another in pairs on the stem. The large pale purple or violet-red flowers, 1½ to 2 inches in diameter, are borne singly on long stalks which spring from the axils of the leaves; they open from June to August. The large petals are five in number, and the corresponding sepals are green, narrow, and very long, extending much beyond the petals.

The fruit (1) may be described as a one-celled capsule opening at the top by means of five teeth. This seed capsule contains from 20 to 40 seeds, and Perseke states that from 1,000 to 2,000 seeds have been counted on a single plant, while Nobbe quotes as many as 2,590. The seeds (2) and (3) are rough, black or dark brown, and irregularly spherical, and owing to their comparatively large size (3 mm. or one-tenth of an inch, or even more, in length) they are not easily sifted from wheat. Winton describes them as "globular-kidney-shaped, resembling a rolled-up caterpillar."

The seeds are odourless, but bitter to the taste when chewed, and their weight averages 8 milligrams (Cornevin). When ground up with wheat they discolour the flour, and are stated to give a greyish tint, disagreeable odour, and

CORN COCKLE (*Agrostemma Githago* L.).

1. Fruit, nat. size. 2. Seeds, nat. size. 3. Seed, enlarged.

bitter taste to bread when baked. Their poisonous character is dealt with below (p. 41).

Corn cockle is a hardy annual, the seed appearing to germinate either in spring or autumn, in the latter case the young plants becoming well established before spring. Thaer says that while botanically an annual it rather appears agriculturally as a biennial, and that the seeds germinate and the first leaves grow at so low a temperature that it appears more as a weed of winter corn than spring corn.

Harm done.—Corn cockle is an undesirable plant in corn-fields for three reasons: it is a weed in the usual acceptance of the term, aiding to crowd out the cereal crop; the seeds are poisonous; and the seeds when ground up with wheat discolour the flour, which would be a disadvantage even were the seeds wholesome.

Prevention and Remedy.—The plant is therefore a weed which should be eradicated. To this end an endeavour should be made to prevent seeding, and this may perhaps be best done, in well-grown corn crops, by hand-pulling the growing plants. Where the weed is known to be very plentiful the seeds may be encouraged to germinate by spring and autumn cultivation, the seedlings being subsequently destroyed by harrowing.

Repeated harrowings of the grain crop may be the means of destroying large numbers of the seedlings.

It will also be a useful measure to abandon autumn-sown cereals for a time in favour of late-sown spring cereals, in which case the winter and late spring tillage will tend to destroy the young seedlings which have appeared.

Short rotations will be a great help in getting rid of corn cockle, and thorough cleansing of root crops will kill a great deal of the weed. "It is quickly suppressed and ultimately eradicated on lands brought under a short rotation of crops." *

It may be suggested that, as the seed of corn cockle ripens about harvest time, a box attachment near the horizontal rollers of a self-binder or behind the platform or pan of a reaping machine will catch many seeds which would otherwise be scattered on the stubble.

* *Farm Weeds of Canada.*

Care should be taken that only pure seed grain be used, and cereal crops intended for seed should be thoroughly cleaned of corn cockle. The weed also grows freely among leguminous crops, particularly vetches, and here also the pest should be hand pulled, while too great care cannot be taken to prevent the seeds being harvested and distributed with the seed. Owing to their size and roughness the seeds are separated with difficulty from wheat or tares by means of ordinary sieves.

Poisonous Character.—We now come to a consideration of the poisonous properties of corn cockle, and as live stock are unlikely to eat the growing plant we may deal solely with the seeds, which may be ground up with flour for human consumption or with food-stuffs for farm stock. Cornevin states that poisoning by corn cockle has occurred in the case of man and all domestic animals. In 1874, he says, evidence in a case at Lyons showed that there were then merchants sufficiently unscrupulous to add 45 per cent. of cockle flour to meals intended for the feeding of stock. Cornevin could only quote the amount of cockle flour necessary to cause death in the case of calves, pigs, dogs, and poultry, and for these animals he found the amounts to be:—

Calf	0·25 lb.	per 100 lb. live weight.
Pig	0·10 ,,	
Dog	0·09 ,,	
Fowl	0·25 ,,	

Since Cornevin's work appeared numerous experiments have been made, and various conclusions have been drawn by different authorities.

In experiments conducted at the Vienna Experiment Station,* bread containing 40 per cent. of cockle-seed meal was eaten by both adults and children, but the results were negative.

In 1892 Kornauth and Arche found by feeding trials that corn cockle was not poisonous to pigs, a conclusion which is contrary to general belief. These investigators found † that while albuminoid metabolism was diminished, fat production was increased; with 70 per cent. of corn cockle in the

* *Exp. Sta. Rec.*, vol. iv, p. 91.
† *Ibid.*, vol. iv, p. 90; vol. v, p. 228.

food the growth of the animals was diminished, though the action did not appear to be poisonous. They even concluded that corn cockle is a harmless food for growing pigs, and refuse containing the seeds is said to be widely used in Hungary for fattening pigs.

About the same time Nevinny stated * that 6 grams of cockle seed consumed in 1,200 grams of bread were beyond doubt poisonous in effect, and that the sale of grain or flour containing it should be forbidden. Kobert, another investigator, was also of opinion that the sale of feeding stuffs containing the seeds of corn cockle should be prohibited by law.†

In 1893 a number of pigs died in Germany when fed on coarsely ground rye tailings containing 6 per cent. of cockle, symptoms of acute poisoning being observed. On the other hand, 40 work-horses were uninjured when given $3\frac{1}{4}$ lb. of similar tailings.‡ In another case five cows were supposed to have been poisoned by corn-cockle seed;§ and in a further instance the cockle was believed to exert a poisonous action on pigs (1904–5).|| In 1903–4 experiments showed that corn cockle exerted a more favourable than unfavourable influence on the total milk yield of cows, but a very unfavourable influence on the quality of butter; and experiments with cows, sheep, pigs, and goats indicated that in the amounts commonly found in feeding stuffs corn cockle has no poisonous action on domestic animals.¶

Hagemann showed** in 1903 that the use of food-stuffs containing corn cockle as usually obtained from milling did not cause poisoning of domestic animals. Pigs received foods containing 60 per cent. of cockle, and cows were given $5\frac{1}{2}$ lb. of cockle per 1,300 lb. live weight per day. Cows receiving foods rich in cockle yielded milk containing an inferior fat of abnormal character.

An extensive study of the question was made by Pusch, who concluded as follows:†† "Under certain conditions

* *Exp. Sta. Rec.*, vol. iv, p. 310.
† *Ibid.*, vol. iv, p. 92.
‡ *Ibid.*, vol. v, p. 813.
§ *Ibid.*, vol. xii, p. 394.
|| *Ibid.*, vol. xvi, p. 103.
¶ *Ibid.*, vol. xv, p. 1001.
** *Landw. Jahrbücher*, vol. 32, 1903, p. 929.
†† *Exp. Sta. Rec.*, vol. iv, p. 90.

corn cockle is injurious to domestic animals. The amount of the poisonous substance in the seed is variable, depending probably upon the season and the soil. Animals become accustomed to it, so that amounts of seed which at first cause sickness, later have no injurious effect. The susceptibility of animals to the poison varies both with the species and the individual. Young animals are more readily affected than older ones. It is believed that rodents and sheep are not susceptible, and, as far as is known, grown cattle are only slightly or not at all affected by the poison. Calves, swine, horses, and especially dogs, are more or less susceptible. Concerning birds and fowls, there is some doubt."

Smith includes corn cockle among simple irritant poisons.

The poisonous principle is variously stated to be *Sapotoxin,* a glucoside, *Smilacin, Saponin,* or *Githagin.* Pesch says * that the seeds contain a poisonous substance named *Saponin* or *Githagin,* a bitter property which may cause nervous debility and dysentery. In the same volume (p. 677) Barnstein says that the poisonous property is due to *Saponin,* the amount of which can, according to his investigations, only be approximately estimated in a meal containing corn cockle.

König states that the seed of corn cockle contains an alkaloid named *Agrostemmin,* which is chiefly present in the seed coat; and also a strongly poisonous substance, *Githagin,* which is a glycoside resembling *Saponin.* It is therefore important that the presence of corn cockle in feeding stuffs should be known.

According to a United States Bulletin,† "the poisonous constituent is very freely soluble in water, and possesses a sharp burning taste. It has no odour, but when inhaled in the smallest quantity it produces violent sneezing. When briskly shaken with water it froths like soap. The poison is found in nearly all parts of the plant, but mainly in the kernel of the seed." With regard to the last statement, it is of interest to note that Cornevin states that the seed coat of corn cockle does not contain the toxic principle.

* *Die Futtermittel des Handels,* 1906, p. 34.
† *Farmers' Bulletin* No. 86, *U.S. Dept. Agric.*

The toxic principle is not removed by the heat of an ordinary oven in baking, or by boiling.

Though the foregoing notes are somewhat contradictory in character, it is clear that poisoning by corn cockle has commonly occurred under a variety of conditions, and the evidence is sufficiently conclusive to show that the ingestion of the seeds should be carefully avoided, and waste material from thrashing, winnowing, or otherwise cleaning grain should always be destroyed when it contains more than a small amount of cockle seed. Indeed, it appears to be generally the best plan to burn all foul screenings.

Identification in Food-stuffs.—When ground up with grain, especially wheat, portions of the black, rough seed-coats remain sufficiently large and characteristic to be recognised under the microscope. Winton says that "highly characteristic of cockle are the large, more or less elongated (up to 600 μ long) epidermal cells with enormously thickened, deeply sinuous, brown walls. These cells form humps, covered on the outer surface with numerous fine warts." Under these outer cellular warty humps, forming the epidermis, are one or more layers of parenchyma cells, and then follow within the large thin-walled cells composing the endosperm, and containing starch bodies. The starch bodies are spindle-shaped, club-shaped, oval, lance-shaped, or sometimes nearly globular. They are 20 to 100 μ in diameter, and easily disintegrate in cold water into minute starch grains, stated by König to be about 1 μ in diameter, roundish and angled. Cornevin describes the grains as 1 to 2 μ and never over 6 μ in diameter. They are perhaps on the average one-fifteenth the size of the starch grains of wheat.

The presence of cockle in mill products, therefore, can be diagnosed by the appearance of the epidermal cells, and by the starch grains.

The chemical tests for corn cockle suggested by Petermann, and by Medicus and Kober, are quoted by König in the volume mentioned below.

Works of Reference.—Experiment Station Record, U.S. Dept. of Agriculture, Volumes IV., V., XII., XV., XVI.

Farmers' Bulletin No. 86, U.S. Dept. of Agriculture.

FIG. 8.—SHEATHED AGARIC

(*Amanitopsis vaginata*).

Untersuchung landwirtschaftlich und gewerblich wichtiger Stoffe, Dr. J. König, 1906.

Die Futtermittel des Handels (Verband landw. Versuchs-Stationen), 1906.

Anleitung zur Bekämpfung des Unkrautes, Dr. K. Perseke, 1896.

Landwirtschaftliche Jahrbücher, Vol. 32, 1903, p. 929.

Handbuch der Samenkunde, Prof. Dr. Fr. Nobbe, 1876.

Microscopy of Vegetable Foods, A. L. Winton, Ph.D., 1906.

Farm Weeds of Canada, Dept. of Agriculture, Ottawa, 2nd Edition, 1909.

Des Plantes Vénéneuses, Ch. Cornevin, 1887.

Common Weeds of the Farm and Garden, H. C. Long, B.Sc., 1910.

Poisonous Plants in Field and Garden, Rev. Professor G. Henslow, 1901.

Landwirtschaftliche Unkräuter, Dr. A. Thaer, 1905.

Poisonous Plants of all Countries, A. B. Smith, 1905.

Transactions of the Highland and Agricultural Society, 1894.

The Complete Grazier, W. Fream, B.Sc., LL.D.

EDIBLE FUNGI.*

SHEATHED AGARIC (*Amanitopsis vaginata*) (FIG. 8).

The cap is bell-shaped, gradually becoming quite flat, with a slight central boss, edge grooved, mouse-grey or lead-colour, 3 to 5 inches across; gills persistently white; stem elongated, rather slender, whitish, the base enclosed in a loose sheath or volva, 4 to 6 inches high.

This is found amongst grass, in woods, &c., during the autumn.

It may be distinguished from certain undesirable kinds, which present a somewhat similar appearance, by the persistently white gills.

The aroma is very delicate and is soon dissipated by heat, so that it is advisable to cook this fungus in a covered vessel.

SCALY AGARIC (*Lepiota rachodes*) (FIG. 9).

This fungus is closely related to the Parasol Mushroom (Fig. 7), differing more especially in the absence of a boss or umbo in the middle of the cap; in the shorter, white stem; and in the flesh instantly changing from white to a reddish-brown colour when cut or bruised.

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* Nos. 1–3 of this series of coloured plates and descriptions appeared in the *Journal* for February, 1910, Nos. 4–6 in March, 1910. No. 7 (The Parasol Mushroom) was issued separately in February, 1909.

It is found on the ground in woods, &c. The flavour is much the same as that of the Parasol Mushroom.

CHOCOLATE AGARIC (*Lepiota emplastra*) (FIG. 10).

The cap is globose when young, and covered with a parchment-like chocolate-coloured skin, which soon becomes rigid, hence, as the cap expands, the coloured skin is broken up into irregular patches, showing the white flesh underneath; 3 to 4 inches across; gills persistently white, stem stout, white, with a ring or frill near the top. The white flesh of the cap and stem becomes stained dull reddish-brown at once when cut.

This fungus always grows under cedars and other conifers, and may be found in late summer and autumn.

The flavour is excellent, but the fungus is not common.

Wart Disease of Potatoes checked by "Greening."

In a previous number of this Journal * some account was given of the advantages derived from the "greening" of potatoes intended for "seed." Further experiments prove that Wart Disease can be checked to some extent by planting "greened" potatoes. "Up-to-Date," a variety very susceptible to the disease, was used for the experiment. Six potatoes that had been "greened" for a period of six weeks, counted from the time they were lifted, and six that had been kept in darkness for an equal period of time, were selected. The "greened" potatoes had very short, dark green sprouts, whereas the sprouts on the potatoes kept in darkness were quite colourless and also very short. The twelve potatoes were planted in pairs—one greened and one ungreened—in soil that had been thoroughly inoculated with the fungus causing Wart Disease. After an interval of six weeks the potatoes were examined, when five of the ungreened ones were found to be infected with the fungus. Two of the potatoes had all the sprouts infected; three each had one sprout infected, the remaining example being quite free from disease. The six greened potatoes were perfectly free from infection with the exception of one sprout that had developed since the tuber was

* Vol. xvi, No. 3, June, 1909.

FIG. 9.—SCALY AGARIC

(*Lepiota rachodes*).

planted, and consequently was in a highly susceptible condition.

Infection of a potato tuber is only possible through the eye, and then only when the sprout is quite young; hence, when the tubers were examined, all had passed the stage of possible infection, and thus represented the percentage of immunity due to "greening."

There are two primary reasons why autumn "greening" of potatoes prevents infection. For some unknown reason the swarm-spores of species of *Synchytrium* * avoid entering cells containing chlorophyll, and all the cells of autumn "greened" potatoes are rich in chlorophyll. Again, the exceedingly slow rate of growth of such sprouts results in the formation of a comparatively thick cuticle and epidermis, through which swarm-spores could not penetrate.

A Disease of Fig Trees.

In February of the present year the Board received from Sussex specimens of diseased wood of fig trees. A considerable area of trees is affected. Examination showed that the disease is due to the fungus *Libertella ulcerata*, Mass. In some respects it produces effects similar to apple canker (*Nectria ditissima*, Tul.), described in Leaflet No. 56, and it might perhaps fittingly be named "Fig canker."

The fungus causes the branch or twig to crack slightly (see illustration), but does not produce the gaping wounds which are caused by apple canker. The wood becomes ashy grey in colour, enabling the diseased wood to be easily distinguished. In badly affected branches all parts above the canker die. In twigs of recent growth the grey colour is not evident, but the twigs die back from the tip. Old trees were found to be much more badly diseased than young ones, and in some cases canker spots could be seen quite close to the ground on the main branches. The fungus appears to obtain access to the wood through wounds due to various

* The fungus causing Wart Disease or "Black Scab" of Potatoes will in future be known as *Synchytrium endobioticum* Percival, and not as *Chrysophlyctis endobiotica* Schilb. as heretofore.

causes—pruning, broken twigs, damage done by men's feet when picking, or the chafing of branches against each other.

It may be pointed out that fig trees do not bear fruit until about 20 years old, trees under this age being considered "young." Trees 20 to 50 years old are of "medium" age, and when 50 to 100 years old they are "old." Fig trees grow slowly for the first 20 years, and very slowly after they commence to fruit. Anything more than the very slightest

FIG TREE DISEASE (*Libertella ulcerata* Mass.).

pruning produces excessive growth and no fruit. Manuring also tends to produce growth of wood and no fruit, and is therefore seldom practised.

The disease is of old standing in Great Britain, and was rampant during the whole time the Royal Horticultural Society occupied the gardens at Chiswick. It appears to be unknown in other countries.

If a branch be "ringed" by the fungus it should be

FIG. 10.—CHOCOLATE AGARIC

(*Lepiota emplastra*).

removed, recovery being impossible. The wood should be cut away well below the point of infection until no trace of diseased wood can be seen. When the injury is confined to one side of a branch the wound should be cut out as cleanly as possible. All parts removed should be burnt, and all wounds made should be at once protected by a coating of gas tar. The fungus only fruits on old, dead wounds, and hence, if diseased patches be removed on their first appearance, the disease will be prevented from spreading. Manures should be employed with caution, as it is usually considered that their application greatly predisposes a plant to attack.

Notes on Insect and Fungus Pests.

Chrysanthemum Leaf Miner.—Two cases of attacks by this fly have been reported to the Board in the past winter; one from Troon and the other from the neighbourhood of Sheffield. In both cases the fly was present in numbers, the correspondent at Sheffield describing his plants as covered with them. The fly (*Phytomyza geniculata*) belongs to the *Agromyzidæ,* a branch of the *Diptera.* (See also *Journal,* Dec. 1907, p. 556). Tobacco extract spray might be tried in addition to the methods there recommended, but as the grub is hidden within the leaf it is very doubtful whether any spray will ever reach it.

Raspberry Beetle.—A correspondent in Cambridgeshire forwarded to the Board in February a specimen of the raspberry beetle (*Byturus tomentosus*), several of which he had found among his canes. The first was found on February 14th.

The mild weather at the time when these beetles were found was no doubt the cause of their early appearance. The beetles were fresh specimens, with the pubescence not at all rubbed. The early date of the appearance of the adults on the plants is worthy of record. (See also *Journal,* September, 1908, p. 433.)

Larch Rust.—A branch of a Scotch fir was recently sent to the Board from a nursery in Northumberland showing in a well-defined manner the presence of larch rust (*Melampsora laricis* Hart). The aecidial stage of this fungus forms yellow pustules on the leaves of the larch, while other stages are passed in the living leaves of poplars and birches. The spores produced on these leaves are conveyed by wind or other means to the leaves of the fir, for which reason when disease is suspected seed-beds of conifers should not be made in the neighbourhood of these trees. The disease, which almost exclusively attacks very young trees, was not reported as being serious in the case above mentioned.

Violet Root Rot.—Bean plants sent from Roweden, Kent, were found to be affected with *Rhizoctonia violacea* (Leaflet 171). They were grown in pots in fresh soil. The outdoor crop last year was lost, and an earlier crop this year was affected.

Insect Depredations in North American Forests.

A Bulletin recently issued by the United States Department of Agriculture (Bureau of Entomology, No. 58, Part V.) refers to the very extensive damage done to forest trees in North American forests by insects, and Dr. A. D. Hopkins, the officer in charge of Forest Insect Investigations, estimates that the loss due to insect pests represents 1 per cent. annually of the total stand of merchantable timber in the United States. This figure, based on the estimated area and stand of the present forests of the United States, and the average stumpage value, is equal to a value of about 13 million pounds sterling annually.

Among the pests which have done widespread damage is the large larch sawfly (*Nematus erichsoni*), which is of special interest owing to its recent extension in Great Britain. As was stated in the recent article in this *Journal*, March, 1910, p. 982, this insect is believed to have destroyed, since 1880, from 50 to 100 per cent. of the mature larch over vast areas in the north-eastern United States and south-eastern Canada.

Many other insects have from time to time been equally

destructive to other species of trees. The southern pine beetle (*Dendroctonus frontalis*, Zimm.) killed a very large percentage of the mature and small pine and spruce trees in 1890-1892 over an area of 75,000 square miles in Virginia, Maryland, Pennsylvania, and North Carolina. Several other bark-boring beetles of the same genus (*D. piceaperda, D. engelmanni, D. ponderosæ, D. monticolæ, D. brevicomis,* and *D. pseudotsugæ,* Hopk.) have also attacked pine timber in different parts of the United States on a very extensive scale. Another prevalent type of insect is the wood-boring beetles, such as the oak timber worm (*Eupsalis minuta,* Dru.), the chestnut timber worm (*Lymexylon sericeum,* Harr.), and others, which render the wood of living timber defective to such an extent as to reduce the value from 50 to 70 per cent.

Until about eleven years ago nothing had been done towards preventing this enormous damage. Since then investigations have been conducted by the Bureau of Entomology of the United States Department of Agriculture, and satisfactory progress has been made in ascertaining the principal insect enemies of the forests of North America, in determining their life history, and in devising practical methods of control. In the first instance, a number of the most destructive insects were found to be new to science, while as regards the more important known species little information was available as to their habits, but it is considered that the advice now available would, "if properly utilized for practical application, evidently prevent from 10 to 30 per cent. of the annual losses at a very small cost."

The work that has been done is, however, only a beginning, and more purely scientific work on the life history of insects is needed to provide a foundation of facts on which practical recommendations can be based. The need for trained experts is also very strongly urged.

In addition to remedies based on a knowledge of the habits of the insect or depending on proper forest management, it is possible in many cases to utilize the natural enemies of the insects.

Dr. Hopkins points out that if it were not for the natural checks and natural factors of control of some of the more destructive insect enemies of forest trees, artificial control

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would in many cases be impossible, and the depredations would be far more continuous and complete. These natural factors consist of parasitic and predatory insects, diseases of insects, birds, adverse climatic conditions, &c., and while these factors exert a powerful influence in preventing a still more extensive waste of forest resources, it has been repeatedly demonstrated that they cannot be depended on to prevent widespread devastations, or to protect the best trees or the best species. Under normal conditions the tendency is towards the preservation of a balance between the warring factors, but the injurious insects frequently gain the ascendancy, and may retain it for two, three, or even ten years before the balance is again adjusted through the influence of the natural enemies or a diminished food supply.

Dr. Hopkins is of opinion that it is better to aim at the artificial reduction of the insects than to attempt to introduce artificially the natural enemies of the injurious insects.

Among these natural enemies are internal or external parasites, or predatory insects, which feed on the young or adult pests, parasitic fungi, and bacteria. The latter sometimes cause epidemics among injurious insects, and often exert a powerful influence in controlling extensive outbreaks. "Indeed, the greatest service rendered by this class of natural enemies is in the frequent sudden appearance of an epidemic which kills off a destructive species of insect after the latter has increased to such numbers and extended its depredations over such vast areas as to be far beyond the control of man or his insect and bird allies. Future investigations may possibly enable such parasitic diseases to be utilized artificially to prevent threatened invasions of defoliating insects."

An American Method of Developing Agriculture.

Great efforts are made by the agricultural colleges in the United States to attract and interest farmers in their work. One method, which seems to be increasingly popular, is to bring instruction to the farmer's door by the use of a special train, from which lectures are given at wayside stations.

An instance of the use of a train in this way was mentioned

in this *Journal* in July last (p. 328), and a similar, but somewhat novel, form of giving instruction has recently been tried in Indiana.

The train was supplied without charge by the Erie Railway Company for the Agricultural Experiment Station of Purdue University, Lafayette, which provided the lecturers and exhibits.

The train was composed of three coaches and a double side-door horse and carriage car. Lectures of 45 minutes' duration each were given at the stations where the train stopped. The lectures were given in the coaches, which had been fitted up with charts by the University; and the horse and carriage car contained three cows for demonstration purposes.

After a lecture of 30 minutes had been delivered a 15-minute demonstration was given in regard to the cows. When the people had assembled on the platform, one of the doors of the car in which the cows were kept was thrown open, and two Jerseys were shown to the spectators. The general run of the demonstration lecture was as follows:—

"Here you see two Jersey cows. Can anyone say off-hand which is the better? The first cow cost about £10 per annum to feed. She produced £11 10*s*. worth of milk or £11 15*s*. worth of butter fat, so you had about 35*s*. profit per annum for the pleasure of milking her twice a day. The second cow, another Jersey, is a better producer, and gave £19 worth of milk. This cow also cost £10 per annum to feed, but she showed a much larger profit. We get at the value of these cows by record. Every farmer should keep a record of his cows, the same as every other business man does of his business and manufacturing costs. The record is the only way to get at the value of cows for dairy purposes."

Pamphlets were then handed round explaining the importance of milk records, and the lecturer continued:—

"There are over 600,000 cows in the State of Indiana. One-third of them are of the same type as the first cow shown, so that about 200,000 cows in this State are producing practically no profit at all. These Jersey cows are more suitable for a district where butter is made. You have the great Chicago market for fresh milk before you, and you should see to it that you get cows that will produce plenty of milk."

The second door was then thrown open and a Holstein cow shown, the lecturer continuing:—

"This is a Holstein cow. She cost £2 more per annum to feed than the Jersey cow, or £12. She produced butter fat valued at £17, or milk valued at £38. The milk from a Jersey cow contains a larger percentage of butter fat, but the Holstein is the milk producer for this fresh milk district. This cow, by record, produces over 1,100 gallons of milk per annum, or about ten times her own weight."

The lecturer then went on to explain the build of the cow, the udder, the milk veins, and the general characteristics that mark a good cow, thus supplementing the points mentioned in the preceding lecture.

From 50 to 200 farmers were present at every station.

At an evening meeting the Railway Industrial Commissioner of Erie, who had accompanied the train, said that he had noticed a wonderful change in the interest taken by the farmers in this train, compared with that taken by them in the first train on milk production, some three years ago. Even when a similar train for improving maize growing went through last spring a great many farmers were too shy to go into the coaches, but this time as soon as the train arrived at the station the farmers rushed into the coaches and took a lively interest in the whole matter.

These trains are provided by the railway companies with the object of developing the agriculture of the district through which their lines run. In this particular case, the railroad company were endeavouring to promote the trade in fresh milk for the Chicago market, by encouraging farmers to keep cows for milk production rather than for butter.

Report on the Acreage and Live Stock Returns of 1909.

The annual Agricultural Statistics are issued in four parts, and Part I. of the volume for 1909, which has recently been published [Cd. 5064, price 5*d*.], deals with the acreage and live stock returns, the preliminary figures of which were given in this JOURNAL for October last (p. 571). The tables are preceded by a report by Mr. R. H. Rew, in the course of which it is

pointed out the total number of holdings over one acre in Great Britain in 1909 was 509,171, an increase of 542 as compared with the preceding year. If a comparison is made with 1905, however, a decrease of 2,533 is shown, mainly in holdings under 50 acres. This may be wholly or partially accounted for by the fact that during this period, 1905–9, the cultivated area of Great Britain was reduced by 103,759 acres, which obviously involved the disappearance of a considerable number of holdings.

In dealing with the changes which have taken place in the area under crops and grass, Mr. Rew remarks that, concurrently with the reduction of the arable land by about three million acres during the past 30 years, there has also been a considerable alteration in the manner in which it is cropped. The proportion under the three chief corn crops was in 1880 about 46½ per cent., whereas in 1909 the proportion was slightly less than 44 per cent. Roots now occupy about the same share of the arable land as they did 30 years ago, but the proportion left in bare fallow has fallen from 4½ per cent. to only 2 per cent. On the other hand, the proportion devoted to clovers and temporary grasses has increased from 25 to 28½ per cent., while about 1 per cent. more of the arable land is now appropriated by potatoes. The change in the relative importance of the corn crops is even more marked. Wheat has declined from 16½ per cent. to 12½ per cent., and Barley from 14 per cent. to 11¼ per cent., while Oats have increased from 16 to 20 per cent. The Wheat acreage has on two occasions fallen as low as 9 per cent. of the total arable land, and generally speaking the fluctuations in the area under Wheat synchronise with those of Oats, but in the opposite direction.

The fluctuations in the live stock in this country present some features of interest, but the position as regards horses is not regarded as entirely satisfactory. In point of actual numbers, this class of stock reached a relatively high total, but an analysis of the figures suggests that the larger number now in farmers' hands may be due to a declining demand.

In the case of cattle, the number recorded was 7,020,982, which was the highest on record. The most constant feature in the returns is the steady increase during the past eight

years of cows and heifers in milk or in calf. The number in 1909 reached 2,794,176, or 30,396 more than in the preceding year. Practically the whole increase occurred in England, the midland counties showing the greatest progress, while in Wales and Scotland there was comparatively little change. So long as the home producer retains his present monopoly of the supply of fresh milk to the community, it appears evident that the cow stock of the country must be augmented to meet the annually increasing demand. There is no doubt a constant tendency, as facilities for the rapid transport of milk are extended, to reduce the manufacture of cheese and butter, but there are obvious limits, which may indeed soon be reached, to the possibility of increasing the milk supply by this means, and the further growth of the milking herd would appear to be necessary to keep pace with the requirements of the people.

The total number of sheep returned was 27,618,419, being the highest recorded since 1892, and nearly half a million more than in 1908. During the past five years the flocks of the country have increased by about 2½ millions, an addition almost as great and as rapid as that which occurred at the beginning of the "'nineties." The low price of mutton throughout the greater part of the year indicated that home supplies had temporarily exceeded demand, but this position may be expected to readjust itself before long. The number of lambs returned was comparatively small in proportion to the number of ewes, so that a smaller increase, if not an actual reduction, in the total number of sheep will probably be revealed at the next enumeration. The price of mutton is influenced by many causes, among which, at any particular period, the abundance or scarcity of "keep" is one of the most important, but there seems no reason at present to suggest that the effect on the markets of the larger number of sheep was more than temporary, or that the flocks of the country are more than sufficient to keep pace with the demand of the increasing population for home-bred mutton.

The number of pigs returned in 1909 was 2,380,887, as compared with 2,823,482 in 1908, showing a decline of 442,595, or 15·7 per cent. The decrease was generally attributed by the collecting officers to the enhanced prices of

corn, offals, and other feeding stuffs, although on the other hand it was stated by some that the increased home demand for pig products tempted pig-owners to slaughter more rapidly, and thus to reduce the number at the time of the enumeration.

The number of pigs returned in June has always been subject to very wide fluctuations from year to year. When it is remembered that the number slaughtered during the year considerably exceeds the number living at any particular date, it is evident that a yearly enumeration must be a somewhat uncertain measure of the movements of the pig population. An examination of the figures for a series of years shows, however, that there is something like an oscillation, disturbed sometimes by exceptional circumstances, but in the main fairly regular. During the past 20 years, for instance, there have been six in which the total has exceeded $2\frac{3}{4}$ millions, viz., in 1890, 1891, 1895, 1896, 1904, and 1908. Between 1896 and 1904 there is an apparent gap, but in 1899 the total, though not reaching what may be termed the proper level, was as high as 2,624,000. In the intervals between these five periods the numbers have fallen either below $2\frac{1}{4}$ millions or within 100,000 of that figure, while on two occasions, viz., in 1892 and 1893, the total little exceeded 2,100,000. With the large number, nearly approaching a maximum, returned in 1908, it was not inconsistent with previous experience that the following year should show a considerable falling off. It must, however, be admitted that the decline in the number of breeding sows by 53,000 in a single year seems disquieting, though in this case again it is reassuring to remember that almost as great a reduction was recorded in 1905.

Report on the Produce of Crops for 1909.

Part II. of the Agricultural Statistics, containing the final Returns of Produce of Crops in Great Britain, has also been published [Cd. 5,095, price $4\frac{1}{2}d.$]. The report which precedes the tables gives a short account of the weather of 1909, and particulars of the duration of the harvest and the weight of grain per bushel.

The relation of the yield per acre in 1909 to the average of the preceding 10 years, represented as 100, is shown thus: Wheat, 107; barley, 111; oats, 104; beans, 96; peas, 95; potatoes, 109; turnips and swedes, 120; mangolds, 107; clover hay, 97; meadow hay, 96; and hops, 71.

It is remarked that, while the crops grown in 1909 were bulky, the condition was seriously affected by the weather during harvest, while in many districts the quantity saved and available for market was substantially less than that actually grown. Any calculation, therefore, of the value of the crops grown, on the assumption that the whole of them were sold, is more than usually open to the objection which has been previously pointed out in connection with all such hypothetical valuations. Subject to this qualification, the total value of the crops gown in 1909, on the assumption that the whole of them were valued at the market price, is given as follows:—

Wheat, £12,640,000; barley, £10,125,000; oats, £13,392,000; potatoes, £9,921,000; clover, &c. hay, £12,478,000; meadow hay, £20,643,000.

Mr. Rew observes that, in consequence partly of the heavier crops grown and partly of a slight increase in the average price of wheat and oats, the total nominal value of the corn crops was considerably greater in 1909 than in 1908, but as the proportion marketed was probably smaller in the later year, it may be doubted whether the gross returns were actually larger. In the case of potatoes and hay the better prices in 1909 would have made up for the smaller crops if an equal proportion had been marketed.

Among the other details given in the report is a table of the total average production of hops in England for four overlapping decennial periods, showing a decline from 470,731 cwt. in 1885-94 to 401,272 cwt. in 1900-9.

The President of the Board of Agriculture and Fisheries has appointed a Departmental Committee to enquire and report as to the character and extent of the British export trade in live stock (including horses and poultry) with the Colonies and other countries, and to consider whether any steps can with advantage be taken by the Board of Agriculture and Fisheries, or otherwise, with a view to its development.

Departmental Committee on the Export Trade in Live Stock.

The Committee will be constituted as follows :—Sir Edward Strachey, Bart., M.P., Parliamentary Secretary to the Board of Agriculture and Fisheries (Chairman); Sir Richard P. Cooper, Bart; Mr. Charles Adeane; Mr. Richardson Carr; Mr. Vaughan Davies, M.P.; Mr. John M. Fraser; Mr. Alex. T. Gordon, Jnr.; Colonel H. Le Roy Lewis, D.S.O.; Mr. T. H. Middleton, M.A., M.Sc., one of the Assistant Secretaries of the Board of Agriculture and Fisheries; Mr. Sanders Spencer; Mr. F. H. Stericker. Mr. A. E. Balleine, of the Board of Agriculture and Fisheries, will act as Secretary.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

EXPERIMENTS WITH CEREALS.

Continuous Growing of Wheat and Barley (*Rothamsted Experimental Station, Ann. Rept. for* 1909.)—The results are given of the crops in 1909 on Broadbalk field, where wheat has been grown continuously for 66 years, and on Hoos field, where barley has been grown continuously for 58 years. The season was wet, and the most noticeable feature was the exceptional reduction of the wheat crop wherever potash had been omitted from the manure. On these non-potash plots rust and other fungoid diseases were particularly prevalent. As a rule potash shows its greatest effect in dry rather than wet seasons.

The Inheritance of Strength in Wheat (*Jour. Agr. Science, Vol. III., Pt.* 1, *Dec.,* 1908.)—The experiments of the National Association of British and Irish Millers have shown that Red Fife, the best-known of the hard Manitoban wheats, retains its strength when grown under English conditions, although very frequently its yield is not great enough for profitable cultivation here. These experiments had for their object the investigation of the mode of inheritance of strength in wheat, with a view to building up a variety having the strength of

* The Board would be glad to receive for inclusion in this summary copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

Red Fife combined with the high cropping capacity of the common English wheats. Professor Biffen's conclusion from the investigations, as far as they are reported in this communication, is that strength is a character transmitted in accordance with Mendelian principles. Knowledge of the mode of inheritance of high- and low-yielding capacities is at present fragmentary, but certain of the strong-grained hybrids raised gave mean yields of 33 bushels per acre, which was equal to those of the high-yielding English parents, Red Lammas and Rough Chaff, while that of Red Fife, the strong-grained parent, was 20 bushels. Consequently little doubt is entertained that high-yielding capacity and strength can be combined in the same variety, and the problem of breeding strong wheats suitable for English conditions should, it is considered, offer no special difficulties.

The Development of the Grain of Wheat (*Jour. Agr. Science, Vol. III., Pt.* 2, *Oct.,* 1909.)—This paper, by A. D. Hall and W. E. Brenchley, deals with the progressive changes in the composition of the grain of wheat during its formation and ripening. A large number of heads of wheat were marked on one day when they were just putting out their first flowers, so that it could be assumed that they were all of the same age, and at the same stage of development. One hundred or more of these marked heads were then taken at intervals of three days until the grain was fully ripe; the grain was extracted and analysed, and in one case the straw was also analysed.

On examination of the curves expressing the results the authors distinguish three stages—the formation of the pericarp, the filling of the endosperm, and the ripening process. The material forming the pericarp contains a larger proportion of nitrogen in the dry matter, and a smaller proportion of phosphoric acid in the ash, than does the endosperm material. As soon as the endosperm begins to fill, the plant moves into it material that is practically uniform in composition at all stages, early and late, in the filling. There appears to be no justification for the opinion usually held that the proteins are moved in first and the carbohydrates later. The ripening process is in the main one of desiccation, although there is some change from non-protein to protein. It is incidentally shown that both the nutrition and assimilation of the plant continue to a much later date than has been usually supposed. The total amount of dry matter, nitrogen, and ash in the plant increases to within a fortnight of harvest. The authors conclude that it would be safe to cut wheat at an earlier stage than is usual, whereby certain mechanical losses by shedding, birds, &c., might be avoided, though it is not certain that a fresh difficulty might not be introduced if an increased time were required to bring the cut corn into a fit condition for stacking.

Varieties of Wheat (*Edinburgh and E. of Scotland Coll. of Agr., Bull.* 18.)—These tests were made in 1908–9 on three farms in South-Eastern Scotland. As the size of the grain varies considerably in different varieties approximately the same number of grains of each variety were sown instead of a measured quantity, the number of grains to the acre being that contained in 4 bushels of White Chaff Squarehead. By this method the rate of sowing worked out approximately as follows:—White Chaff Squarehead (East Lothian seed), 4 bushels; White Chaff Squarehead (Essex seed), 4 bushels; Standard Red, 4½

bushels; Browick, 4 bushels; Stand-up White, 3½ bushels; Red Chaff Squarehead, 4¾ bushels. Taking into account the yield of saleable grain and the straw, per acre, the following is the order of merit:—Browick (average 67 bushels saleable grain), White Chaff Squarehead (65¼ bushels), Carter's Stand-up White (62¼ bushels), Webb's Standard Red (60¼ bushels). The yields of saleable grain of the Essex and East Lothian seed of White Chaff Squarehead were identical, though the Essex seed produced the greater weight of straw. The best standing varieties were Carter's Stand-up White and Browick. Samples of the varieties of grain were valued, and taking into consideration the quality as well as yield, the most profitable varieties were White Chaff Squarehead (East Lothian seed) and Carter's Stand-up White. Browick and the Essex White Chaff Squarehead were a few days later in ripening than the others, and through being cut when less ripe were lower in quality.

Varieties of Wheat, Beds. C.C., Agr. Educ. Comm., No. 8, *Report upon the Wheat Plots,* 1909.)—Eighteen varieties were grown on $\frac{1}{5}$-acre plots, the seed being drilled at the rate of 2 bushels per acre. The following were the best yields in bushels per acre:—Rivet 47, White Stand-up 39, Kinver Red 38, Browick White Chaff 38, Red Stand-up 36, Red Standard 35. Of these White Stand-up was of poor quality, much sprouted. The summer was not favourable, the majority of the plots being more or less laid, and the harvest was late. The results are said to confirm those of previous seasons, namely, the best yields were obtained from those varieties that stood the best. They not only filled and ripened better, but also were not attacked by pigeons and other birds to any great extent, as was the case with the laid plots.

Varieties of Oats and Barley (*Aberdeen and N. of Scotland Coll. of Agr., Leaflet* 8.)—These trials have been carried on for a number of years for the purpose of comparing the newer prolific kinds of oats with those in more general cultivation. The plots in 1908 were $\frac{1}{10}$-acre in extent, and the grain was sown at the rate of 3½ million seeds per acre, except in the case of the Potato oat, where on account of its exceptional stooling power only 3 million seeds were used. At five centres the following yields in bushels of dressed grain were obtained:—Banner 58, Thousand Dollar 56, Siberian 53, Beseler's Prolific 52, Highlander 51, Potato 45. Mr. R. B. Greig observes that after hundreds of tests it is impossible to avoid the conclusion that several varieties of oats available to the farmer are much more prolific than some which are in general cultivation. The origin of the seed should be known, for it is probable that some who have tried one or other of the American varieties and found them unsuccessful have not obtained the kind they paid for. During the five years, 1904–8, the average gain over Potato by the use of Banner has been 11 bushels per acre. The best variety for any particular district can not yet, however, be confidently recommended. The individual results seem to show that Banner and its like do best on the good land, Potato sometimes being more profitable where the land is naturally poor, while in some cases one variety is exceptionally well suited to a particular district or farm.

It is sometimes asserted that while Banner and other grain-producing varieties are suited to the better land and climate of Morayshire and Nairn, they are failures in the later districts close to Aberdeen. Accord-

ingly, in 1908 the two varieties named were compared on seven farms in the neighbourhood of Aberdeen, with the result that Banner produced on the average 14 bushels more per acre of dressed grain. Milling tests were made of all the varieties, but showed very little difference in the quantity of meal produced.

The barley trials were designed to ascertain whether the strains in common use in the North of Scotland, where the grain is mainly sold for distilling or feeding, are the most productive. Eight varieties were sown on $\frac{1}{10}$-acre plots at the rate of $2\frac{1}{2}$ million seeds per acre. Common Barley gave the largest average yield of grain, 42 bushels, but the smallest yield of straw. Danish Archer gave one bushel less grain and 5 cwt. more straw, while there was little difference between most of the others. It is concluded that while "it would be injudicious to draw any conclusion from the results of one season's experiments, the evidence tends to show that the Danish Archer is a valuable variety. Unfortunately it is at least a week later than Common barley, and that characteristic will prevent its general adoption in most of the northern counties. Ideal was a poor crop in nearly all cases, and appears to be quite unsuitable for local conditions. Maltster stood up well and gave a fair crop of good quality. On the whole, however, Common barley has justified its place in general estimation so far as the trials have shown for the season under review."

Influence of Artificial Manures on Barley (*Univ. of Leeds, Bull.* 75).—Five experiments have been carried out in the four years 1900–3, and four experiments in the three years 1904–6, for the purpose of ascertaining the manurial requirements of barley when grown as a second corn crop on a medium loam, and also on the Wold soils of the East Riding. The rotation, which is fairly common in Yorkshire, was as follows :—(1) Roots, (2) Barley or Oats, (3) "Seeds," (4) Wheat or Oats, (5) Barley. The manures used were (1) sulphate of ammonia 1 cwt., (2) sulphate of ammonia 1 cwt., superphosphate 2 cwt., (3) sulphate of ammonia 1 cwt., superphosphate 2 cwt., kainit 2 cwt. Nitrate of soda in substitution for sulphate of ammonia, and also guano and salt were tried. The conclusions arrived at are summarised as follows :—

(1) Where barley is grown as a second corn crop, a satisfactory increase in the yield of grain and straw can be obtained by using artificial manures, provided that a nitrogenous ingredient be included in the dressing.

(2) Except in very wet seasons, nitrate of soda will almost invariably produce a higher yield of grain on Wold land than a dressing of sulphate of ammonia containing the same weight of nitrogen. On the average the latter will be only about 70 to 75 per cent. as effective as the former.

(3) In most cases the yield will be increased if, along with nitrogenous manure, either a phosphatic manure (*e.g.* superphosphate), or a potassic manure (*e.g.* kainit), or possibly both, be employed.

The requirements of the soil for phosphate and potash will, however, be less than for nitrogen, and will vary greatly for different soils. The necessity or otherwise for additions of phosphatic or potassic manures, or both, to the nitrogenous manures can therefore only be determined by actual trial.

As a general rule a manure mixture containing all the three

ingredients—a "complete" manure—will give the heaviest yield of grain, but will not necessarily be the most profitable.

(4) The use of phosphatic and potash manures unaccompanied by soluble nitrogenous manure may seriously reduce the yield of grain below that obtainable on the unmanured soil.

(5) Provided the most profitable combination of manures has been ascertained, as stipulated above in (3), a substantial profit may be expected from the increase in yield of *saleable grain* alone, to which may be added the value of the extra yield of straw.

Taking the most remunerative plot in each year, the increase in the yield of saleable grain, when valued at 27*s.* per qr., has shown in every case a substantial surplus over the cost of the manures, the average surplus for the nine experiments being 17*s.* 10*d.* per acre. Even with the least remunerative of the plots receiving nitrogenous manure, in only three of the nine experiments did the increase in the yield of saleable grain not cover the cost of manuring, and on the average of the nine a surplus of 3*s.* 6*d.* per acre is indicated.

(6) The use of guano is less profitable than an equal expenditure on a suitable mixture of "artificial" manures.

(7) The malting value of the grain is, in general, not appreciably affected by the use of artificial manures, their influence, if any, being quite overshadowed by the influence of the climatic conditions during the ripening period.

In the best barley season (1901) during the seven years covered by the experiments, the finest malting barley was that grown with the aid of a mixture of nitrate of soda, superphosphate, and kainit.

(8) With regard to the use of salt the results obtained in these experiments are not quite conclusive. Further tests are necessary before reliable general conclusions on this point can be formulated.

Samples of the barleys were analysed in six years in order to ascertain to what extent the application of nitrogen, phosphate, and potash in the manure might have affected the proportion of those ingredients in the grain. The results obtained are given in this report, and it is considered to be quite clear that the proportions of nitrogen, phosphate and potash are not directly affected by the manures applied to the crop. The question of the connection between the proportion of these ingredients and the malting quality of the barley is also discussed, but no direct connection has yet been traced.

Continuous Corn Growing (*Roy. Agr. Coll., Cirencester, Scientific Bulletin No.* 1, 1909).—In 1881 it was decided to start this experiment on continuous corn-growing. Twenty-four plots of $\frac{1}{10}$-acre each were laid out, and until 1885 were cropped without manure, in order that some idea might be formed of the capacity of each plot, and to equalise and reduce the condition of the soil, which varied considerably. In each year afterwards various manures were applied, and barley was grown continuously for seven years.

On the average for the seven years superphosphate and potash together gave no increase in the crop. Farm-yard manure at first gave little increase, but as residues accumulated in the soil there was a distinct increase in yield of both grain and straw. In seven years the average increase over the unmanured plot was 3 bushels of grain and 4 cwt. of straw, with 7 tons per acre of manure, and $8\frac{3}{4}$ bushels of grain

and 7 cwt. of straw with 14 tons. Superphosphate 3 cwt., and nitrate of soda $1\frac{1}{2}$ cwt., supplying 26 lb. of nitrogen, gave an average gain during four years of nearly 12 bushels of grain and 8 cwt. of straw; 2 cwt. of nitrate of soda did slightly better. In all the comparable series nitrate of soda gave rather better results than sulphate of ammonia containing the same quantity of nitrogen, *viz.*, $1\frac{1}{4}$ to $2\frac{1}{4}$ bushels more grain, and 2 or 3 cwt. more straw.

Since 1891 the plots have been cropped irregularly, but nearly every year the manures applied to the different plots have been the same as those applied in the beginning, and in future the plots are again to be brought under exact experimental conditions.

Summary of Foreign Experiments.

Use of Sulphur as a remedy for Potato Scab (*Deutsche Landw. Presse, 5 March,* 1910.)—An experiment is being conducted at the Horticultural and Viticultural Institute, Ahrweiler, on the use of sulphur as a remedy for potato scab, with very favourable results. It was found that the proportion of diseased potatoes obtained from a plot treated with sulphur, at the rate of 356 lb. of flowers of sulphur to an acre, was much less than in the case of an untreated plot. The addition of potash to the sulphur, in the proportion of 178 lb. of 40 per cent. potash to an acre, gave even better results. It was also observed that the soil of the plot so treated was looser, freer from weeds, and gave a larger yield of potatoes.

An experiment with artificial manures was combined with the preceding experiment and the addition of superphosphate, nitrate of soda, and potash to the sulphur-treated plots was found to give a greatly increased yield over plots which were neither manured nor treated with sulphur or which were manured only, or treated with sulphur only.

The experiment is not yet concluded, but observations taken during 1909 suggest that the application of sulphur produces a physical improvement in the soil, and has a very favourable effect upon the availability of the plant-food both in the soil and in the artificial manures.

IMPORTATION REGULATIONS.

Importation of Potatoes into Ireland.—The Department of Agriculture for Ireland have issued an order, dated February 15th, 1910, prohibiting the landing in Ireland of any potatoes brought from the Continent of Europe.

Proposed Prohibition of Importation of Potatoes into Sweden.—The Board of Agriculture are informed that, in order to prevent the introduction of potato disease into Sweden, the Swedish Board of Agriculture have recommended the total prohibition of the importation of potatoes into that country.

Importation of Bees and Honey into Lourenço Marques.—The Board of Trade are in receipt, through the Foreign Office, of copies of Regulations recently issued prohibiting the importation of bees into the district of Lourenço Marques without a special permit (to be obtained from the Entomological Section of the Department of Agriculture), and entirely prohibiting the importation of honey, either in the comb or extracted and bottled, from countries other than South Africa.—(*Board of Trade Journal, March* 3rd, 1910.)

OFFICIAL CIRCULARS AND NOTICES.

Fertilisers and Feeding Stuffs (Limits of Error) Regulations.

The Board have addressed the following circular letter, dated February 26, 1910, to Local Authorities in Great Britain, with reference to the new Limits of Error Regulations under the Fertilisers and Feeding Stuffs Act, 1906 :—

SIR,—I am directed by the Board of Agriculture and Fisheries to enclose herewith a copy of the Fertilisers and Feeding Stuffs (Limits of Error) Regulations, 1910.

These Regulations revoke the Fertilisers and Feeding Stuffs (Limits of Error) Regulations, 1906, and embody the provisions of those Regulations with the following amendments :—

(1) The limits of error for Soya Bean Cake are fixed at one-eighth per cent. for oil and one-eighth per cent. for albuminoids.

(2) The limits of error for Dissolved Bones have been extended to Vitriolised or Vitriolated Bones, whether raw or steamed or boiled.

(3) The note to the Second Schedule has been amended so as to make it clear that ammoniacal or nitric nitrogen is not to be included in calculating the percentage of albuminoids from the percentage of nitrogen.

(4) A note has been added to the Second Schedule which extends its application to meal made by grinding cake and meal from which oil has been removed by any process.

(5) Compound Meals are mentioned separately from Compound Cakes so as to make it clear that the term Compound Meals includes mixed meals containing the products of other seeds than oil seeds.

I am to suggest that copies of this letter and of the Regulations referred to should be supplied to the Official Agricultural Analyst for the district of your Local Authority. Duplicate copies are enclosed for the purpose.—I am, &c., T. H. ELLIOTT, Secretary.

Departmental Committee on the Irish Flax-Growing Industry.— The Vice-President of the Department of Agriculture for Ireland has appointed a Departmental Committee "to inquire into the present state of the flax-growing industry in Ireland and the causes which are contributing to the decline of that industry, and to submit recommendations." The address of the Secretary to the Committee is 19 Upper Merrion Street, Dublin.

Departmental Committee on Small Educational Endowments.—The President of the Board of Education has appointed a Committee to inquire into the administration of (*a*) Endowments, the income of which is applicable to, or is applied to or in connection with, Elementary Education, and (*b*) small Educational Endowments other than the above, in rural areas, the application of which to their proper purposes presents special difficulties; and to consider how far under the existing law it is possible to utilize them to the best advantage; and whether any and, if so, what changes in the law are desirable in the direction of conferring upon County and other Local Authorities some powers in respect of such Educational Endowments or otherwise.

Mr. C. P. Trevelyan, M.P., will be Chairman of the Committee, and Mr. W. R. Barker, an Examiner of the Board of Education, will act as Secretary.

MISCELLANEOUS NOTES.

Agricultural Exhibitions Abroad.

Exhibition at Ekaterinoslav.—With reference to the notice in this *Journal* (Nov., 1909, p. 676) relative to an exhibition to be held this year at Ekaterinoslav, the *Commercial and Industrial Gazette* (St. Petersburg) of 11th February notifies that the exhibition authorities have decided to open a special pavilion for the display of models of all kinds of agricultural machinery and implements, drawings, &c.—(*Board of Trade Journal, March* 3rd, 1910.)

Agricultural Exhibition at Prague.—H.M. Consul at Prague (Capt. A. W. Forbes) has forwarded copies of the programme of an agricultural exhibition, organized by the Central Agricultural Society of the Kingdom of Bohemia, to be held at Prague from 14th to 22nd May next. Foreign exhibits will be received at the exhibition, which is an annual one. A section is included for novelties in connection with agricultural machinery and implements, and a competition will be held for chaff-cutting machines. Applications for space should be addressed to the offices of the "Société Centrale d'Agriculture, Vodickova ul. 38," Prague.

Copies of the programme mentioned above may be obtained by intending British exhibitors on application to the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.—(*Board of Trade Journal, March* 10th, 1910.)

International Agricultural Exhibition in Chile.—The *Diario Oficial* of 28th January publishes a law authorising the President of Chile to expend a sum of 300,000 pesos in the organization of an International Agricultural Exhibition and a National Industrial Exhibition, to be held in September next.

Supplement to the Journal.

A Supplement is issued with the present number of the *Journal* dealing with the objects and work of the International Agricultural Institute at Rome.

The International Agricultural Institute was founded in 1905 with the co-operation of the governments of most of the principal countries of the world, and since that time great progress has been made in placing the organization of the Institute on an effective basis.

The Board of Agriculture and Fisheries think, therefore, that it may be opportune to bring to the notice of agriculturists in Great Britain the objects and work of the Institute in order that they may become acquainted with the efforts which are being made on behalf of agriculturists in all parts of the globe.

Copies may be obtained from the Board of Agriculture and Fisheries, Whitehall Place. Price 4*d.*, post free. It is supplied to subscribers to the *Journal* without extra charge. The supplement contains two state-

ments, made respectively by the President and the Vice-President of the Institute, explaining the way in which the Institute has been organized, and the results that it is hoped to obtain.

Notes on Agriculture Abroad.

The Soy Bean Trade of Manchuria.—The following particulars have been furnished to the Board of Trade by the Acting British Consul-General at Mukden (Mr. R. Willis) :—

Up to the year 1907, so far as can be ascertained from the only Customs figures available, viz., those for the port of Newchwang, the export of soy beans from Manchuria did not exceed 120,000 tons annually. During the year 1908 the export rose to approximately 330,000 tons; one half of this was exported from Dairen, and of the remainder 100,000 tons were shipped from Newchwang and 65,000 went out by rail *viâ* Suifenho *en route* to Vladivostok. This increase was almost entirely due to the demand from Europe, which continued throughout 1909, and seems likely to increase rather than diminish. Taking the Customs figures from October, 1908, to June, 1909, no less than 660,000 tons of beans left Manchuria, 341,000 tons from Dairen, 177,000 from Suifenho, and 142,000 from Newchwang. Beans were still being shipped throughout July and August, so that the total of last year's crop exported may be estimated as between 700,000 and 800,000 tons.

At present prices—say 6*l.* 10*s.* per ton laid down in London—experts estimate that Europe can take annually no less than 1,000,000 tons of beans, and there is little doubt that at this price the supply would be available.

The beancake exports in 1908 amounted to 500,000 tons, and from October, 1908, to June, 1909—*i.e.*, the 1908 bean crop—the export rose to 570,000 tons. The native mills, it is stated, only extract from 6 to 7 per cent. of oil from the raw product, and if the demand continues the Chinese will find it more profitable to divert a portion of the beans used in these mills to Europe. There is further abundant space for development; it is estimated that not more than two-fifths of Kirin province is under cultivation, and considerably less than that proportion in Hei Lung Chiang.

Sale of Agricultural Machinery in Russia.—The British Vice-Consul at Kharkov (Mr. C. Blakey) reports that arrangements are being made whereby Peasants' Credit Associations shall take agricultural machinery from selling firms on the terms of sale or return. The Credit Associations would be liable for any damage done to the machines while in their hands, and would receive a commission on sales effected. A form of contract between Associations and firms has been drawn up, and approved by the Head Administration of Small Loan Credit Institutions. This method of trade is very likely, says the British Vice-Consul, to be used by German manufacturers of ploughs and drills.

Cattle Breeding and Dairy Farming in Sweden.—H.M. Consul at Stockholm (Mr. H. M. Villiers, M.V.O.) has forwarded the following information regarding farming in Sweden, taken from an article in a Stockholm newspaper :—

Owing to the unusually good harvest of 1908 a considerable decrease in the import of corn into Sweden was expected in 1909. The wheat import diminished by about 7 per cent., and the maize import by 50 per cent. In the imports of oats, however, which were formerly one of the most important articles of export, there was a considerable increase, viz., from 63,837 metric tons in 1908 to 77,509 tons in 1909, while the very low oat export remained stationary. The imports of rye also increased considerably, viz., from 50,242 tons in 1908 to 84,257 tons in 1909. This rise is the more remarkable when it is remembered that the imports of rye flour have more than doubled, while at the same time the exports of this article have decreased. There is thus a growing dependence in Sweden upon imported corn. A transformation is taking place in the country from corn growing to cattle and dairy farming. The exports of butter are increasing and have nearly regained the ground lost during several bad fodder years previous to 1905. The exports last year amounted to 19,216,000 kilos., as compared with 18,157,000 kilos. in 1908. The exports of milk and cream have increased, the former from 648 (metric) tons in 1908 to 2,113 tons in 1909, and the latter from 192 tons in 1908 to 429 tons in 1909.—*Board of Trade Journal,* March 24, 1910.

Notes on the Weather in March.

During the *first* week the weather over Great Britain was mostly fine. Temperature was above the normal everywhere; in the southern and eastern half of the country warmth was described as "moderate," while in the northern and western districts it was "unusual." Bright sunshine was in excess of the average in all districts, and rainfall was under average everywhere except in England N.W. and Scotland W.

In the *second* week the weather became very unsettled. Rain fell every day in some part of the kingdom, often very generally. The fall was "heavy" in England E. and S.E., and in Scotland E. and W., elsewhere "moderate." Sunshine was either "moderate" or "scanty." Temperature, however, was above the average, being "unusual" in every district of Great Britain.

The *third* week was mostly dry, with sunshine and low temperature, the prevailing winds being from the west. Warmth was "deficient" in England S.E. and S.W. and the Midland counties, and elsewhere "moderate." Rainfall was "moderate" in Scotland, and "light" everywhere in England except in the east. Sunshine was "very abundant" in England S.E., "abundant" in England E., "Midland Counties," S.W. and N.W., and "moderate" in England N.E. and Scotland.

During the *fourth* week the dry weather continued, no rain falling over the greater part of England. The sky was, however, sometimes cloudy or hazy over a considerable area, and bright sunshine was only "moderate" in nearly every district. At the same time warmth increased, being "unusual" in most districts, and "moderate" in England E., S.E., and S.W.

Notes on Crop Prospects Abroad. The following information has been published by the International Institute of Agriculture, Rome, in the *Bulletin of Agricultural Statistics* for March (No. 3) :—

The condition of the crops is given in tabular form as follows :—

CONDITION OF CROPS (100 = average.)

Country.	Winter Wheat.		Winter Rye.		Winter Barley.	
	Feb. 1st, 1910.	Mar. 1st, 1910.	Feb. 1st, 1910.	Mar. 1st, 1910.	Feb. 1st, 1910.	Mar. 1st, 1910.
Belgium ...	95	85	98	90	100	90
Bulgaria ...	5·3 [1]	120	5·3 [1]	115	5·3 [1]	117
Canada ...	92	92	—	—	—	—
Denmark ...	95	96	98	97	90	95
Hungary ...	108	110	102	108	110	110
Japan	—	98	—	—	—	88
Luxemburg ...	2·24 [2]	92	1·91 [2]	101	1·72 [2]	100
Roumania ...	105	105	105	105	100	100
Sweden ...	100	100	100	100	—	—
Switzerland ...	96	95	92	95	100	101
Tunis	103	100	—	—	102	100

[1] Scale 1 to 6 : 6 = very good ; 4 = average.
[2] Scale 1 to 5 : 1 = very good ; 3 = average ; 5 = very bad.

The following notes are given on the condition of the crops :—

Bulgaria.—Damage caused by frost, rotting, cracking, floods, and by the *Agrotis segetum* is generally slight.

Denmark.—Heavy falls of snow and rain during February. However, especially in the islands, the damage caused is not so great as was believed.

Hungary.—Damage caused by insects 2–3 per cent. The area of winter barley is 157,000 acres, 107·8 of the area harvested in 1909.

Japan.—The area of winter wheat is 1,107,000 acres; of winter barley 3,221,000 acres; and of winter oats 52,000 acres (condition on March 1st = 146).

Luxemburg.—With the exception of some damage caused to wheat by the heavy rains during February, the condition of the crops is, in general, very satisfactory.

Mexico.—The area of winter wheat is 1,452,000 acres, or 66·8 per cent. of the area in 1909; and of barley 1,556,000 acres.

Roumania.—Weather conditions favourable. Crops in excellent condition.

Spain.—The area of winter barley is 3,403,000 acres, 97·8 of the area harvested in 1909; and of winter oats 1,277,000 acres, 104·1 of the area in 1909.

Switzerland.—Up to the present the crops have not suffered from the winter. In certain districts complaints are being made of damage caused by slugs (Eastern Switzerland) and by mice (Romanic Switzerland). Late sowings are still rather weak. Here and there the heavy rains of February have done damage in the fields. The area of winter wheat sown is 94,350 acres; of winter barley 3,200 acres.

Tunis.—The area of winter wheat is now estimated as 988,000 acres, 103 per cent. of the area harvested in 1909; of winter barley 1,136,000 acres, or 102 per cent.; and of winter oats 153,000 acres, or 101 per cent.

The following table shows the information received by the International Institute up to March 18th, as to harvest of the present season 1909–10 in the countries of the southern zone.

AREA AND PRODUCTION OF WHEAT IN THE SOUTHERN ZONE.

Name of Country.	Area harvested (1909–10).			Production (1909-10). Preliminary statement.		
	Absolute figures.	Compared with last year (1908-09).	Compared with average of previous 10 years.	Total production. Absolute figures.	Compared with last year.	Compared with average of previous 10 years.
	acres.	per cent.	per cent.	cwt.	per cent.	per cent.
Argentina	14,416,279	96	129	71,335,000	85	110
Australia	6,245,941	119	111	43,917,000	131	161
Chili	[1] 1,432,600	131	(1903–6) 161	[1] 12,594,000	131	1903–6) 180
New Zealand	311,200	123	141	5,116,000	109	136
Peru	—	—	—	787,000	—	—
Uruguay	[1] 716,300	—	(1899–1907) 105	[1] 5,136,000	—	(1899–1907) 154

[1] Approximation.

Argentina.—The preliminary estimate of the Government for the production of oats in 1909–10 is 40,717,000 bushels of 32 lb., and of maize 197,000,000 bushels of 56 lb.

The British Consul at Buenos Aires (Mr. W. Townley), writing on March 2nd, says that during the early part of February there were general rains, which would have still further improved the maize crop if it had not been for ravages by locusts. The wet was followed by hot dry weather, and after the middle of the month general rains occurred again, and it is thought that the maize harvest will be considerably larger than that of last year.

New Zealand.—The following are the official preliminary estimates for the harvest 1909–10 :—Rye, 100,000 bushels, barley 1,500,000 bushels, maize 700,000 bushels.

Hungary.—According to the Report of the Agricultural Ministry, dated March 12th, the winter-sown area in Hungary shows a general increase, especially in the case of winter wheat, which shows an extension from 8,040,800 acres to 8,385,100 acres.

Russia.—The British Vice-Consul at Nicolaieff (Mr. J. P. Bagge) has furnished, under date February 26th, the following particulars

regarding the condition of the grain crops in the Governments of Kherson, Kharkov, Poltava, Taurida and Kieff :—

Winter-sown wheat and rye are in splendid condition, the plants being strong and well advanced, with long roots. The weather has been most favourable, exceptionally mild with much snow and rain, and since there is much moisture in the ground the crop prospects are exceedingly good. The acreage under winter-sown grain is rather less than usual, owing to the prolonged drought in the early autumn. The sowing of the spring crops will be undertaken during March.

The *Nachrichten für Handel und Industrie* (Berlin) publishes the following particulars, taken from a Russian paper, of the Russian winter crops in 1909 :—

In the seventy-three governments and territories of Russia, 85,771,300 acres were in 1909 sown with wheat and rye, an increase of 2,646,500 acres, or 3·18 per cent., as compared with the previous year, and of 1,635,500 acres, or 1·87 per cent., as compared with the average of the five years 1904–8. The acreage under wheat and rye increased particularly in the Trans-Dnieper district (by 1,447,000 acres, or 16·93 per cent.), in the southern Steppe district (by 861,000 acres, or 15·38 per cent.), and in the Central Asiatic district (by 40·72 per cent.). The total production of winter wheat in 1909 was 5,498,300 tons, and of winter rye 21,947,600 tons.

Roumania.—A despatch from the British Minister at Bucharest states that the outlook in Roumania is described as most satisfactory. Farmers have not seen such promising conditions for years. The surface sown for 1910 is greater by 750,000 acres than that sown in 1909, and the surface sown with wheat alone is five million acres. If the present favourable climatic conditions continue the harvest should be quite exceptional, both as regards quantity and quality.

Australia.—The Imperial Trade Correspondent at Perth (Mr. J. F. Conigrave) reports, under date of February 15th, that the present season has been exceptionally favourable throughout Australia for the production of cereals, with the result that there has been a record aggregate yield. The estimated total yield for the current season for the whole Commonwealth, with the exception of Queensland, for which statistics are not yet available, is 92,071,764 bushels. Victoria is at the head of the States with 28,535,250 bushels and then follow New South Wales with 25,600,000 bushels and South Australia with 20,139,575 bushels. Western Australia has established a record in its yield of wheat this year, the aggregate estimate being 5,978,829 bushels. The average yield of wheat for the whole Commonwealth was 13·13 bushels per acre, as against 11·89 bushels last season.—(*Board of Trade Journal, March* 17, 1910.)

India.—The Second General Memorandum on the wheat crop for the season 1909–10, issued by the Director-General of Commercial Intelligence, states that the total area sown is now reported to be 27,710,600 acres, which is to be compared with the 25,863,300 acres of last year, and with the 27,901,500 acres forming the average of the five years ending 1907–8. As compared with last year, there is an increase of 1,847,300 acres, or 7·1 per cent., whereas the acreage still falls short of the older average by 190,900 acres. The estimates for the States of Mewar, Banswara, and Dholpur, have not come to hand; but these

tracts usually contain some 73,000 acres, so that the total shortage is probably more like 117,000 acres. The condition of the crop is reported to be good on the whole.

United States.—The Crop Reporting Board of the Bureau of Statistics of the Department of Agriculture reported on the 8th April that the average condition of winter wheat on April 1st was 80·8, against 95·8 on December 1st, 1909, 82·2 on April 1st, 1909, 91·3 at the corresponding date of 1908, and 87·0 the mean of the averages for April 1st of the past ten years.

The average condition of winter rye on April 1st was 92·3, against 94·1 on December 1st, 87·2 on April 1st last year, 89·1 at the same date in 1908, and 89·5 the mean of the April averages of the past ten years.

Agricultural Labour in England during March.

The Board of Agriculture and Fisheries have been furnished by the Board of Trade with the following report, based on returns from correspondents in various districts, on the demand for agricultural labour in March.

Agricultural labourers were regularly employed on the whole during March. Owing to the backward state of farm work there was a somewhat greater demand for day labourers than in the previous month, but the supply was in general quite sufficient.

Northern Counties.—Regularity of employment was general, except with a few day labourers in Yorkshire. The supply of such men was quite sufficient, and in some districts there was a surplus. At the March hirings in Northumberland men were said to be more plentiful, and wages showed a downward tendency.

Midland Counties.—Correspondents report that employment was regular, except in Worcestershire, where some day labourers are said to have lost time through rainy days. There was a good demand for such men in several counties; the supply was usually adequate, but some shortage was reported from the Cannock (Staffs.), Hardingstone (Northants.), and Buntingford (Herts.) Unions.

Eastern Counties.—In Norfolk and Suffolk a few day labourers lost time at the beginning of March through wet weather, and some men in Essex were prevented from obtaining employment in the latter part of the month through the land being unfit to work upon. The supply of such men was in general sufficient, but a shortage was reported from some districts of Lincolnshire.

South and Southern Counties.—Except in Kent and Sussex, where there was some hindrance on account of wet weather, employment was regular in this group of counties. The supply of day labourers was generally sufficient. A Berkshire report, however, mentions a demand for such men, and there was some scarcity of men for tending cattle and milking. A scarcity of men for permanent situations is also reported from Gloucestershire.

THE CORN MARKETS IN MARCH.

C. KAINS-JACKSON.

The recent course of the markets has been unfavourably affected by the Easter holidays, Mark Lane being closed from the 23rd to the 30th, and holders of granary stocks accepted unduly depressed prices in order to clear before this very long adjournment, and so escape a week's warehouse charges. The resumption of business at the fag end of the month was not brisk, but those who had been firm in holding over Easter asked rather more money for their grain, and with very moderate imports of all articles except oats were sometimes in a position to obtain it.

Wheat.—The condition of English wheat has shown slow but quite unbroken improvement as the month proceeded, for dry weather, with sharp drying winds, was the chief weather feature, and this exactly suited thrashings. Prices gradually hardened for the better lots, but a desire to sell the poorer samples and be quit of them was manifested in so many country markets that the imperial average did not improve as it would have done on sales of good milling quality only. In Kent alone prices have steadily averaged thirty-four shillings.

Foreign wheat has recovered the shilling lost in February on American and Canadian fine quality rich in dry gluten. This is in large demand for mixing. New crop Argentine, on the other hand, has fallen in price, as it proves to be inferior to that of last year. The shipments, however, are much smaller than in 1909, and holders of what is on passage showed before the month was out an inclination to stand out over price. Russian wheat is maintained with great stability at 40*s*. to 42*s*. per 496 lb. Its intrinsic milling value is high, sometimes of the highest, but it is impossible to buy on grade; the samples need very careful inspection, and disputes are unfortunately more rife than in any other branch of buying. Consequently the business done in Russian wheat is not nearly so large as might be expected, especially in a year when Russia has a very heavy surplus.

The quantity of wheat on passage has increased on the month to 3,900,000 qrs., but is still rather less than at this time last year. More than two million qrs. are Australian, which indicates the probability of white wheat of only medium milling strength predominating on the markets of the early summer. Strong red wheat, therefore, should pay to hold.

Shipments for March were 426,000 qrs. from North America (mostly high quality Canadian), 1,208,000 qrs. from South America, 1,578,000 qrs. from Russia, 111,000 qrs. from Europe S.E., 193,000 qrs. from India, and 983,000 qrs. from Australia. Considerable contracts for April and May shipment from India have been entered into, but business for future shipment from the two Americas has been less than usual.

Flour.—London millers have reduced their credit and delivery prices by 6*d*., but this has been the result of country rather than of foreign competition. Flour from East Anglia continues to be sent to London

in quantity at 25*s*. to 26*s*. for all-English, and 32*s*. to 33*s*. for best patents from millers noted for a clever use of the best imported wheat to strengthen the home produce. Canada is shipping very fine flour at a thirty shilling level, and of America's 270,000 sacks shipped in March the proportion of Canadian was high. There are now 168,000 sacks on passage.

Barley.—Both quality and prices have been unsatisfactory. Some fine Chilian came to hand in the middle of the month, and was at once absorbed, while Californian brewing grade comes in very usefully. The month's shipments were 872,000 qrs. from Russia and 74,000 qrs. from Europe S.E., but the good barley exports from California, Chile, and Anatolia were quite small. Chile is expected to be a freer shipper in April and May, but at present only 300,000 qrs. of barley are on passage from all countries.

Oats.—Demand is decidedly better as compared with a month ago, and at 5*s*. per cental the competing foreign sorts do not lack buyers. The use of oatmeal for pigs and poultry is said to be larger to-day than it has ever been before. Statements of this kind can neither be verified nor ignored, but it may be noted that despite imports, in thirty weeks, of 4,087,000 qrs. (against 2,738,000 qrs. last season), the warehouses are not over-stocked. Many excellent judges think that oats from May to August will be dearer for all sorts. Shipments for March were 444,000 qrs. from South America and 523,000 qrs. from Russia.

Maize.—Prices have declined in a somewhat unexpected manner, and 25*s*. was not exceeded for American in the week before Good Friday. The last two days of the month, however, saw 6*d*. recovery at Mark Lane and Bristol respectively. The new Argentine crop is offered for June shipment at 24*s*. 9*d*. per qr., but this will not allow of August sales in England at much below 26*s*. per qr. Many expect that maize in June, if not in May, will improve on currencies, but the consumption of Indian corn at that date is at its lowest, and the abundance of cheap Russian oats and barley seems this season to have affected inquiry generally. March shipments were 434,000 qrs. from North America, 127,000 qrs. from Russia, and 160,000 qrs. from Europe S.E. There are only 330,000 qrs. on passage; which is much below the average.

Oilseeds.—The dearness of oilseeds continues. March closed with 63*s*. per 416 lb. paid for Indian linseed, and 61*s*. for Argentine. Cottonseed at 10*s*. 6*d*. per cwt. for Egyptian was very stiffly held. There were 142,000 qrs. of linseed and 53,000 tons of cottonseed on passage.

Oilcake.—Linseed cake, London made, was obtainable at the end of March for 9*s*. per cwt. to large wholesale buyers. This was 3*d*. decline from February. Russian at 8*s*. 9*d*. per cwt. was in freer offer. The price of cottonseed cake has risen 3*d*. per cwt., 6*s*. 6*d*. per cwt. being about the lowest cash price for Egyptian. Where London make (the best) is required, 7*s*. 3*d*. per cwt. is demanded, and 7*s*. was being obtained.

Various Feeding Stuffs.—Beet sugar has risen 10*d*. per cwt. on the month, and 2*s*. 4*d*. on the three months, prices being January 1st, 12*s*. 6*d*.; February 28th, 14*s*.; March 31st, 14*s*. 10*d*. The tendency in other sweet fattening foods is uniformly upward at the present moment. Owing to news of a good crop in India, rice is a little easier to buy. Bran, sharps, and middlings have been obtainable at moderate prices,

now and again $1d.$ or $2d.$ per cwt. lower than February. Rye has fallen $1s.$, and at $26s.$ per 480 lb. is a useful feeding stuff.

THE LIVE AND DEAD MEAT TRADE IN MARCH.

A. T. Matthews.

Fat Cattle.—The cattle trade in March was of a singularly even character. Supplies were generally good and of fully average quality. Not only have the variations in the average prices been small from week to week, but if we except about four or five markets the quotations from all parts of the country only varied about $\frac{1}{2}d.$ per lb. A careful examination shows that first quality Shorthorns have realised almost exactly the same price as they did during February. The average of this class of cattle in March was about $8s.\ 3\frac{1}{2}d.$ per 14 lb. stone, and for second quality, $7s.\ 7\frac{1}{4}d.$ Herefords averaged about $1d.$ more, while Devons exceeded the latter by a similar amount. Prices in London were fully $1\frac{1}{2}d.$ per stone above the general average for best Shorthorns, owing to the excellent supplies of Norfolk-fed Shorthorns of moderate weights and good finish. Looking back to the corresponding Metropolitan market last year, we find that these cattle were fetching exactly the same price as they are to-day, viz., $8s.\ 5d.$ per stone. On the same days in 1908 and 1907 the price was $7s.\ 7d.$ and $7s.\ 10d.$ respectively, and in 1906, $7s.\ 7d.$ Taking recent years for comparison, we may therefore consider present prices fairly satisfactory to the feeder.

Veal Calves.—The trade in fat calves was very steady at full prices, the general average in twenty-three British markets being $9\frac{1}{2}d.$ per lb. for first, and $8\frac{1}{2}d.$ for second quality. Local demand varies greatly for veal, as well as the supply, and during March there was often a difference of $2d.$ per lb. between the highest and lowest English markets. In the week ending March 17th, while prime calves were fetching $10\frac{1}{2}d.$ per lb. at Leicester and Derby, they were only worth $8\frac{1}{2}d.$ at Ipswich.

Fat Sheep.—The extraordinary advance in sheep values was continued, and culminated in the attainment of the highest levels of recent years. One remarkable feature of the upward movement was its gradual and steady character. There were cases in which a rise of $\frac{3}{4}d.$ per lb. occurred from one market to the next, but, broadly speaking, prices have crept up, week by week, a farthing at a time. In the third week the general average for prime small Down tegs in seventeen English markets reached $9\frac{1}{4}d.$ per lb, and that for second quality, $8\frac{1}{4}d.$ Two of the cheapest markets in that week were Ipswich and Norwich, where the top price was $8\frac{1}{2}d.$, which was rather curious seeing that those places are supplied with Suffolk Downs, one of our very finest breeds of butcher's sheep. Hereford certainly was quoted no higher, but at Salford Downs were worth $10\frac{1}{4}d.$, and at about eight other markets, $9\frac{1}{2}d.$ Longwools have fully shared in the return of prosperity, and tegs have averaged, in about fourteen markets, $8\frac{3}{4}d.$ and $9d.$ per lb. Ewes have fetched $6\frac{1}{4}d.$ and $6\frac{1}{2}d.$ per lb., a rise of $2d.$ per lb. from the

lowest point. London had a nice show every week of Scotch half-breds, but they did not command any higher price than the best Downs of either breed. At some of the northern markets, however, both these sheep and Cheviots reached the high figure of 10½*d.* per lb.

In the second week clipped sheep began to appear, and by the 17th were fairly numerous, though none were exposed in the London market. The great advantage of keeping the fleece at home was again exemplified. Many flockmasters are fully aware of this advantage, and will never sell a turnip-fed sheep in the wool if they can possibly avoid doing so. Certainly it is by no means an uncommon occurrence for the fleece to be virtually given away at Islington market. Among the markets held about the middle of the month where clipped sheep were offered, were Hull, Leeds, Lincoln, Salford, Wakefield, Wolverhampton, and York, and prices ranged from 7*d.* to 8¾*d.* per lb. Obviously the difference in value between the clipped and the woolled sheep was far less than the value of the fleece. It should be observed that the season has been very unfavourable for feeding on turnips, owing to the very wet winter, and that sheep are not weighing at all well in consequence. Fat lambs met a very irregular trade, making high prices in the North of England, frequently touching 1*s.* 4*d.* per lb.

Fat Pigs.—There was no increase in the general supply of fat pigs, and values showed a further advance of about 1½*d.* per 8 lb. stone.

Carcass Beef—British.—The trade, while remaining steady, and indeed, improving to the extent of about ¼*d.* per lb., did not by any means share in the excitement which characterised that in foreign beef. Scotch short sides of best quality sold at Smithfield at 6¾*d.* to 7*d.* per lb., and long sides at 6¼*d.* to 6½*d.*, while the best English on offer made about 6*d.* It was commonly remarked that home-fed beef, and especially Scotch, was relatively the cheapest in the market.

Port-Killed Beef.—Supplies were very moderate, and there was a gradual advance in prices. At the beginning of the month the best Deptford-killed was fetching 5¾*d.* per lb., but later it was worth about 6½*d.*

Chilled Beef.—There was an upward tendency in all qualities of chilled beef, and the movement was very pronounced on the 22nd at London Central Market. First quality Argentine hindquarters advanced from 4½*d.* to 5½*d.* per lb., and best North American from 6¼*d.* to 7*d.*, during the month.

Frozen Beef.—Perhaps the most noteworthy event of the month was the strong rise in "hard" beef. It is a long time since it was fetching 4½*d.* per lb., and it rose gradually to that figure by the 22nd, for best hindquarters, having started at 3⅝*d.* Forequarters were nearly as dear, and fetched up to 4⅛*d.* per lb.

Carcass Mutton—Fresh Killed.—There was a slow market during a portion of the second week, and prices slightly receded. Recovering later, however, an advance of fully ¼*d.* per lb. was established, with very little difference between the value of Scotch and English, the best qualities of both being about 8*d.* per lb.

Frozen Mutton.—Prices varied a little from week to week, but gradually hardened, and by the end of the month New Zealand was fetching 4½*d.* to 5*d.* per lb.

Carcass Lamb.—Demand was very slack, and 1*s.* per lb. was rarely exceeded in London.

Veal.—There was a fair trade for best veal, and prices for both English and Dutch ruled steady at 7½*d.* to 8*d.* per lb.

Pork.—Supplies were moderate, and London prices for prime small carcasses were often as high as 8*d.* per lb.

THE PROVISION TRADE IN MARCH.

HEDLEY STEVENS.

Bacon.—There has been no improvement in the situation during the month, but a steady advance in prices, more especially in American descriptions. Hogs in the United States made record prices during February, but still higher figures have been paid during March, as high as $11.17½ being reached, whereas $7.15 was top price in March, 1909, and $5.95 at same time two years back. Recent advices from the United States report that the conditions cannot improve until the farmers have had time to increase their stocks, and we may expect these extreme prices until possibly the end of the year. Cables at the end of the month were asking 85*s.* per cwt. for some cuts, which were selling at about 52*s.* the same time last year, and 41*s.* two years earlier. Shipments to the principal English ports for March have been extremely small, for one week to Liverpool the quantity being only 5,200 boxes, which is about a third of the receipts of twelve months back. In the United States the demand keeps good in spite of the high prices, and letters report that the difficulty is not in selling, but in obtaining enough goods to fill the orders. Here the demand has fallen off to such an extent that enough stock can be found to fill all orders, but there are no reserve stocks, and the pinch will be felt later, when arrivals are still further reduced. On spot some descriptions of American hams are making 30*s.* per cwt. over prices current at the same time last year.

Arrivals from Canada are still very small, packers apparently sending along just sufficient to keep their brands on the various markets, and the prices realised for the best brands are practically the same as those current for English and Irish sides.

English pigs continue very scarce, and prices realised must be very satisfactory to the breeders. Considerable interest is apparently now being taken in some districts in the rearing of pigs, with satisfactory results, but some time must elapse before any real relief is possible.

Cheese.—Although trade has improved during the month with wholesale dealers, there has been only a slight increase in consumption. Nevertheless prices have generally hardened, stocks of Canadian being reduced, especially of white. Values are still a little below those current at the same time last year, but it is anticipated that we shall see further advances early in April, when the consumption of this article of diet usually increases, especially as it is cheap in

comparison with the prices current for butter and bacon. Arrivals from New Zealand continue large, and by the end of the month some accumulation of stock had taken place, chiefly in coloured. On the month Canadians have advanced 1*s.*–3*s.*, and New Zealands 2*s.*–3*s.* per cwt.

Stocks of old cheese are nearly cleared in Canada. Recent advices from the Ingersoll section report that there is not much snow in that district, and that the weather has been mild and congenial for dairying. A few fodder goods were being made for the home trade, and it is thought present prices will tempt farmers to make more "fodders" in that district, as in the butter districts less early cheese will probably be made, the former paying better at the present difference in prices.

In the United States of America prices are a little easier, say from 79*s.* to 82*s.* per cwt.

At the end of the month the estimated stocks of Canadian cheese at the three principal distributing centres (London, Liverpool, and Bristol) were 164,000 boxes, against 137,000 last year, and 153,000 two years ago.

The demand for English cheese has been good throughout the month, and prices have been a little firmer. Stocks of the earlier makes are now in small compass.

Butter.—Butter has experienced considerable fluctuation during the month, prices showing a variation of fully 8*s.* to 10*s.* per cwt. The lowest point was at the commencement of the month, but the demand for Easter trade helped sellers to command more money. After these orders were filled, the market again sagged, but had somewhat recovered by the end of the month. Sentiment is against present high prices, which are from 20*s.* to 22*s.* per cwt. higher than last year, so that buyers operate from hand to mouth.

The arrivals from Australia and New Zealand continue large, but it is anticipated that present figures will continue to the middle of April, when arrivals from the Continent will be freer, also the early Irish makes will be offered on the English markets.

All descriptions of secondary butter are very scarce, and are fetching prices relatively above their value.

Imports from Argentina are more liberal, but still slightly under those of last year, when a record was established for that period.

Both the United States of America and Canada require all their present stocks for home consumption. Prices in the former country are slightly higher than during February, when fancy descriptions were fetching about equal to 153*s.* per cwt., delivered in this country.

Eggs.—There has been a largely increased production of English and Irish, and the demand being chiefly for strictly fresh lots, the Continental imports have been forced at lower prices to induce business. There was a moderate Easter demand, prices favouring buyers. By the end of the month "picklers" had commenced in earnest to secure their supplies, which should relieve the pressure to sell.

PRICES OF AGRICULTURAL PRODUCE.

Average Prices of Live Stock in England and Scotland in the Month of March, 1910.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	England. First Quality.	England. Second Quality.	Scotland. First Quality.	Scotland. Second Quality.
Fat Stock:—	per stone.*	per stone.*	per cwt.†	per cwt.†
Cattle:—	s. d.	s. d.	s. d.	s. d.
Polled Scots	8 6	8 1	39 10	36 3
Herefords	8 5	7 10	—	—
Shorthorns	8 4	7 7	38 8	35 9
Devons	8 6	7 11	—	—
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	9½	8½	9½	7¼
Sheep:—				
Downs	9¼	8¼	—	—
Longwools	9	8	—	—
Cheviots	10	9¼	9½	8¼
Blackfaced	9½	9	8½	7¾
Cross-breds	9¼	8½	9¾	8½
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs:—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	7 11	7 5	8 1	7 2
Porkers	8 5	7 10	8 4	7 5
Lean Stock:—	per head.	per head.	per head.	per head.
Milking Cows:—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	21 18	17 18	22 0	17 16
,, —Calvers... ...	21 0	17 8	20 6	17 1
Other Breeds—In Milk ...	18 11	14 13	18 17	15 19
,, —Calvers ...	—	11 5	18 15	16 4
Calves for Rearing	2 6	1 15	2 17	2 2
Store Cattle:—				
Shorthorns—Yearlings ...	10 0	8 7	9 15	8 6
,, —Two-year-olds...	14 0	12 4	15 7	12 2
,, —Three-year-olds	17 3	15 5	16 19	14 9
Polled Scots—Two-year-olds	—	—	16 17	14 6
Herefords— ,,	15 13	14 7	—	—
Devons— ,,	14 19	13 4	—	—
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	42 11	36 3	—	—
Scotch Cross-breds ...	—	—	32 0	27 3
Store Pigs:—				
Under 4 months	30 7	23 7	25 8	19 8

* Estimated carcase weight.

† Live weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND and SCOTLAND in the Month of March, 1910.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Quality.	Birmingham.		Liverpool.		London.		Manchester.		Edinburgh.		Glasgow.	
		per cwt.		per cwt.		per cwt.		per cwt.		per cwt.		per cwt.	
BEEF :—		s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
English	1st	55	0	55	0	56	0	53	0	54	6*	57	6*
	2nd	51	0	51	6	54	0	51	0	50	6*	53	6*
Cow and Bull ...	1st	49	6	45	6	45	0	48	6	44	6	46	6
	2nd	44	0	39	6	38	6	45	0	38	6	40	6
U.S.A. and Canadian :—													
Port Killed ...	1st	52	6	55	0	56	6	53	0	—		53	6
	2nd	46	6	51	0	53	6	50	6	—		51	6
Argentine Frozen—													
Hind Quarters...	1st	38	0	38	0	36	6	38	6	38	0	32	6
Fore ,, ...	1st	34	0	33	6	32	6	33	6	33	6	30	6
Argentine Chilled—													
Hind Quarters...	1st	44	6	45	6	43	0	45	6	45	0	43	6
Fore ,, ...	1st	35	6	35	0	34	0	35	0	35	0	34	0
American Chilled—													
Hind Quarters—	1st	58	6	59	0	60	0	59	0	59	0	—	
Fore ,, ...	1st	39	6	39	6	40	6	39	6	40	0	—	
VEAL :—													
British	1st	75	0	81	0	73	6	79	0	—		—	
	2nd	65	6	72	6	68	0	72	6	—		—	
Foreign	1st	—		69	6	72	0	70	0	73	6	—	
MUTTON :—													
Scotch	1st	—		82	0	72	6	81	6	71	0	74	6
	2nd	—		76	6	68	6	77	0	60	0	65	6
English	1st	68	0	75	6	68	0	77	0	—		—	
	2nd	59	6	71	6	65	0	73	6	—		—	
Argentine Frozen ...	1st	37	0	36	6	37	6	36	6	36	0	36	6
Australian ,, ...	1st	35	6	34	0	34	0	34	0	—		36	0
New Zealand ,, ...	1st	—		—		43	0	—		—		—	
LAMB :—													
British	1st	107	6	116	6	115	6	107	6	—		—	
	2nd	99	0	—		100	0	—		—		—	
New Zealand ...	1st	53	6	52	0	54	0	52	0	54	0	53	0
Australian	1st	46	6	45	6	47	0	45	6	44	6	45	0
Argentine	1st	46	6	46	6	48	0	46	6	45	6	46	0
PORK :—													
British	1st	70	6	70	0	73	0	69	0	68	0	65	6
	2nd	64	0	65	0	68	0	64	6	60	0	63	0
Foreign	1st	—		—		68	6	—		—		—	

* Scotch.

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1908, 1909 and 1910.

Weeks ended (*in* 1910)	WHEAT.			BARLEY.			OATS.		
	1908.	1909.	1910.	1908.	1909.	1910.	1908.	1909.	1910.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Jan. 1 ...	35 1	32 0	33 3	26 9	26 7	25 1	18 4	17 4	17 4
,, 8 ...	35 2	32 9	33 6	26 9	26 11	24 11	18 3	17 5	17 2
,, 15 ...	35 5	32 8	33 8	27 1	27 1	24 11	18 5	17 5	17 7
,, 22 ...	35 6	33 2	33 9	26 11	27 3	24 11	18 5	17 8	17 6
,, 29 ...	35 0	33 0	33 6	26 11	27 6	25 0	18 4	17 9	17 4
Feb. 5 ...	34 3	33 4	33 7	26 9	27 7	24 10	18 3	17 10	17 7
,, 12 ...	33 1	33 8	33 4	26 9	27 8	24 9	18 0	17 11	17 11
,, 19 ...	32 6	34 1	33 0	26 5	27 11	24 6	17 11	18 0	18 0
,, 26 ...	30 11	34 5	32 7	26 3	28 0	24 2	17 8	18 0	17 10
Mar. 5 ...	30 5	34 10	32 7	26 1	27 11	24 6	17 8	18 2	18 1
,, 12 ...	31 3	35 8	32 6	26 0	28 4	24 1	17 10	18 2	18 0
,, 19 ...	31 7	35 9	32 6	26 2	28 0	23 6	17 11	18 5	18 0
,, 26 ...	31 4	36 0	32 9	25 10	28 0	23 7	17 10	18 6	17 11
Apl. 2 ...	31 3	36 5	33 0	25 5	27 10	23 8	17 9	18 8	18 0
,, 9 .	31 2	37 4	33 6	25 10	28 0	23 1	17 7	18 10	17 11
,, 16 ...	30 11	38 7		26 1	27 8		17 7	19 2	
,, 23 ...	30 10	41 4		25 5	28 2		17 9	19 9	
,, 30 ...	31 6	42 5		25 8	27 10		18 0	20 0	
May 7 ...	32 4	40 9		25 5	27 7		18 4	20 3	
,, 14 ...	33 1	41 6		24 9	27 3		18 7	20 6	
,, 21 ...	33 8	42 8		25 9	27 0		18 10	20 11	
,, 28 ...	33 5	42 6		24 6	26 3		18 8	21 0	
June 4 ...	33 1	43 1		25 10	25 7		18 4	21 3	
,, 11 ...	32 7	42 11		24 5	26 10		18 4	21 4	
,, 18 ...	32 0	42 7		24 2	26 10		18 5	21 6	
,, 25 ...	31 5	42 8		24 0	27 2		18 7	21 7	
July 2 ...	30 11	42 9		23 11	27 2		18 7	21 9	
,, 9 ...	30 5	43 0		24 4	26 4		18 5	21 8	
,, 16 ...	30 7	43 3		23 1	26 10		18 5	21 9	
,, 23 ...	31 5	44 0		26 5	27 4		18 6	22 5	
,, 30 ...	31 10	43 5		24 4	24 6		18 7	22 2	
Aug. 6 ..	31 6	44 9		23 1	27 4		18 9	22 11	
,, 13 ...	31 6	44 9		23 10	24 9		18 1	21 8	
,, 20 ...	31 2	41 6		24 5	23 11		17 10	19 8	
,, 27 ...	30 10	38 5		24 5	24 7		17 1	19 4	
Sept. 3 ...	30 10	37 2		25 5	26 3		17 3	19 6	
,, 10 ...	31 5	34 11		25 11	26 1		17 6	18 5	
,, 17 ...	31 7	33 6		26 0	26 5		17 3	17 9	
,, 24 ...	31 5	32 9		26 8	26 8		17 2	17 7	
Oct. 1 ...	31 7	32 2		26 11	26 9		17 2	17 2	
,, 8 ...	31 5	31 8		27 5	26 9		17 0	17 0	
,, 15 ...	31 2	31 4		27 6	27 0		17 0	17 0	
,, 22 ...	30 11	31 8		27 5	27 7		16 11	16 11	
,, 29 ...	30 8	31 10		27 5	27 9		16 11	17 0	
Nov. 5 ...	30 11	32 5		27 6	27 9		17 0	17 0	
,, 12 ...	31 2	32 5		27 4	27 7		17 0	17 1	
,, 19 ...	31 10	32 7		27 3	27 0		17 3	17 4	
,, 26 ...	32 3	33 0		27 2	26 8		17 5	17 3	
Dec. 3 ...	32 7	33 3		27 2	26 1		17 4	17 4	
,, 10 ...	32 8	33 3		27 0	25 7		17 4	17 3	
,, 17 ...	32 9	33 2		26 9	25 3		17 3	17 4	
,, 24 ...	32 2	33 1		26 8	25 2		17 2	17 4	

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lbs.; Barley, 50 lbs.; Oats, 39 lbs. per Imperial Bushel.

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE, BELGIUM, and GERMANY, and at PARIS, BERLIN, and BRESLAU.

—		Wheat. 1909.	Wheat. 1910.	Barley. 1909.	Barley. 1910.	Oats. 1909.	Oats. 1910.
		s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
France :	February	38 8	41 0	26 2	25 11	20 4	21 6
	March	39 4	41 11	26 5	25 11	21 0	21 10
Paris :	February	39 8	42 7	23 3	24 8	20 11	21 7
	March	37 11	43 1	23 3	24 8	20 11	21 6
Belgium :	January	34 2	36 0	25 10	23 8	19 8	19 2
	February	36 0	36 7	26 1	23 6	19 10	19 7
Germany :	January	42 8	44 8	29 9	26 5	21 11	21 2
	February	44 9	45 11	29 6	25 10	22 6	21 6
Berlin :	January	44 11	48 8	—	—	23 3	22 11
	February	47 0	48 9	—	—	23 9	23 1
Breslau :	January	40 5	45 10	30 8 (brewing) 26 2 (other)	26 2 (brewing) 24 6 (other)	20 8	20 4
Breslau :	February	42 1	45 7	30 8 (brewing) 26 0 (other)	25 4 (brewing) 24 2 (other)	21 4	20 6

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*, the prices for the German Empire representing the average of the prices at a number of markets.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of March, 1909 and 1910.

—	Wheat. 1909.	Wheat. 1910.	Barley. 1909.	Barley. 1910.	Oats. 1909.	Oats. 1910.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
London...	36 9	33 8	25 7	22 10	19 1	19 1
Norwich	35 5	32 3	27 9	23 4	18 1	17 8
Peterborough	35 1	31 9	26 6	22 2	18 0	17 3
Lincoln...	35 0	31 11	27 11	23 2	17 11	17 11
Doncaster	34 7	31 9	28 7	24 7	18 0	18 0
Salisbury	36 3	32 10	29 4	24 0	18 2	17 9

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND and SCOTLAND in the Month of March, 1910.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Bristol. First Quality.	Bristol. Second Quality.	Liverpool. First Quality.	Liverpool. Second Quality.	London. First Quality.	London. Second Quality.	Glasgow. First Quality.	Glasgow. Second Quality.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British ..	15 6	14 6	—	—	15 6	13 6	16 0	—
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery	—	—	—	—	—	—	—	—
,, Factory	—	—	—	—	—	—	—	—
Danish ...	—	—	133 6	131 0	131 6	129 6	133 6	—
Russian ...	—	—	—	—	121 6	119 6	121 0	—
Australian ...	125 0	120 6	125 0	123 0	124 0	122 0	128 0	124 0
New Zealand	127 0	123 0	126 0	124 0	125 6	123 6	128 0	—
Argentine ...	125 0	121 6	125 0	123 0	126 0	122 6	127 0	—
CHEESE :—								
British—								
Cheddar ...	74 0	62 0	73 6	71 6	84 0	66 6	67 0	61 6
			120 lb.	120 lb.	120 lb.	120 lb.		
Cheshire ...	—	—	80 0	71 0	87 0	71 6	—	—
			per cwt.	per cwt.	per cwt.	per cwt.		
Canadian ...	63 6	61 6	63 0	60 0	64 0	61 6	62 6	60 0
BACON :—								
Irish	78 0	74 0	77 6	75 6	78 0	76 0	79 0	76 0
Canadian ...	74 0	71 6	73 6	72 0	75 0	72 6	73 6	71 6
HAMS :—								
Cumberland ...	—	—	—	—	108 0	100 0	—	—
Irish	—	—	—	—	101 0	91 6	99 0	91 0
American (long cut) ...	76 6	72 0	77 6	73 0	75 0	—	74 6	71 6
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British ...	8 9	7 6	—	—	10 0	8 9	—	—
Irish	8 5	8 1	8 9	8 3	9 5	8 4	7 10	7 2
Danish ...	—	—	8 9	—	9 10	7 10	8 6	7 6
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Langworthy ...	70 0	63 0	80 0	75 0	81 0	63 0	70 0	63 0
Scottish Triumph	70 0	60 0	53 6	48 6	72 0	61 0	—	—
Up to Date ...	75 0	63 0	53 6	48 6	72 0	61 0	60 0	55 0
HAY :—								
Clover ...	90 0	75 0	106 0	79 0	103 0	78 0	82 0	77 0
Meadow ...	75 0	60 0	—	—	91 0	69 0	81 0	73 6

DISEASES OF ANIMALS ACTS, 1894 to 1909.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

Disease.	March.		Three Months ended March.	
	1910.	1909.	1910.	1909.
Swine-Fever :—				
Outbreaks	94	103	297	366
Swine Slaughtered as diseased or exposed to infection ...	671	1,149	2,210	3,209
Anthrax :—				
Outbreaks	134	107	410	359
Animals attacked	179	178	512	518
Glanders (including Farcy) :—				
Outbreaks	30	51	94	147
Animals attacked	72	262	262	522
Sheep-Scab :—				
Outbreaks	39	58	282	370

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)

Disease.	March.		Three Months ended March.	
	1910.	1909.	1910.	1909.
Swine-Fever :—				
Outbreaks	5	3	11	8
Swine Slaughtered as diseased or exposed to infection ...	82	58	296	71
Anthrax :—				
Outbreaks	—	1	4	2
Animals attacked	—	1	6	2
Sheep-Scab :				
Outbreaks	63	62	253	227

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PICKING, DRYING, AND PACKING HOPS.*

ARTHUR AMOS, B.A.

Time of Picking.—There are a variety of circumstances that influence the date upon which hop-picking is begun in any district. In average years, early hops are ripe, and picking begins in most parts of England during the first week in September, though in Hereford and Worcester it is usually a week later. In order to secure the crop at its best, picking should not last longer than three weeks.

It is always a difficult problem to fix the day upon which to begin picking. The hops remain at their prime for only a very few days, and it is of the greatest importance to secure the crop at its best.

The loss incurred by picking unripe hops is very serious. In the first place, unripe hops contain a smaller proportion of dry matter, and consequently more bushels of unripe hops are required to produce a hundredweight of dry hops than is the case with ripe hops, this difference often amounting to 10 or 20 per cent. of the crop.

Secondly, the quality of unripe hops is lower than that of ripe hops. The colour of the sample is green instead of yellow, and the hops contain less lupulin, consequently the aroma is poor, and the hops, owing to the small amount of lupulin, are said to "cut thin."

On the other hand, if picking is delayed too long, the

* The following articles dealing with hops have appeared in recent numbers of this *Journal*:—"The Insect and Allied Pests of the Hop," by F. V. Theobald, M.A., October and November, 1909; "Hop Cultivation," by Arthur Amos, B.A., February, 1910.

result is no less serious. Over-ripe hops soon "lose colour"; in other words, the colour changes to a reddish-brown, particularly if mould is present, or in the event of a wind, and the value of the hops is greatly reduced.

Tests for Ripe Hops. (i) *Colour.*—The colour of hops during the time that they are actually growing and until they begin to ripen is bright green; as the cones ripen this colour gradually changes to a greenish-yellow, and at the same time becomes paler.

(ii) *Texture.*—Unripe hops when pressed between the fingers feel soft and flabby; as they ripen the hops become more crisp, and rustle when pressed.

(iii) *Seeds.*—The condition of the seeds is one of the best guides to the ripeness of hops. Hop seeds are at first quite soft and contain a whitish watery substance. The seeds of ripe hops, on the other hand, are purplish in colour, quite firm, and contain a nutty kernel.

(iv) *"Condition."*—The amount of lupulin, often called "Condition," is comparatively small in unripe hops; it gradually increases in amount as the hops ripen. If a ripe hop is broken open and the strig and bases of the petals are rubbed with the fingers, the lupulin from the hop makes the fingers sticky. This stickiness may be used as an indication of the ripeness of the hops.

Other Factors Influencing the Date of Picking.—There are several other factors besides the ripeness of the hops that a grower has to consider when fixing the date of picking.

(i) *Size of Crop.*—Picking must be started early in years when a large crop is grown, and late when a small crop is grown. If the crop is a large one, it is better policy to pick a few unripe hops at the beginning of picking than to risk losing some of the last pickings entirely, through the hops being over-ripe. On the other hand, in the case of a short crop there is no danger of the hops becoming over-ripe, and all efforts should be directed to securing the crop at its best.

(ii) *Disease.*—If, in spite of all precautions, a few lice remain in the hops, which are just getting ripe, picking should be commenced early. A few lice in the early pickings

do not materially lower the value of the crop (except in so far as the weight per acre is reduced by early picking), whereas, if the hops are left to get "dead-ripe," the aphides increase with astonishing rapidity, filling the hops with their excrement, and finally dying. A black mould grows upon the excrement and the dead bodies of the aphides, making the inside of the hops black and the crop well-nigh worthless.

In the case of moulded hops, again, picking should be hurried forward, because the white mould quickly gives rise to the red form as soon as the hops get ripe, and the presence of this reduces the value of the sample.

(iii) *Varieties Ripening in Sequence.*—Several varieties of hops are, as a rule, grown on each farm, some early, some medium, and some late, so that the hop-picking may be extended over as long a period as possible. In those cases, however, in which such a sequence is not grown, it will usually be found necessary to commence picking before the hops are fully ripe.

HOP-DRYING.—Hop-Drying is the most difficult and at the same time the most important of all the operations connected with Hop-Growing. One dryer by careful management can increase the value of the whole crop by 10*s.* per cwt.; whilst a careless dryer can spoil many oastings, even to the extent of half their value.

The object of drying hops, like that of harvesting other crops, is to convert them from a damp state into one of comparative dryness, so that the hops may be kept for a considerable time without undergoing decomposition or loss of valuable properties. Well-dried hops can be kept for two or three years in cold storage without depreciating in value to any serious extent.

Before drying, hops contain various amounts of moisture, depending upon the degree of ripeness and the variety of hop. In the process of drying, 65 to 75 per cent. of water is evaporated from the hops, which, however, still contain, after drying, from 8 to 10 per cent. of moisture.

The drying process in the common open-fire system consists briefly of spreading the hops out upon a horsehair cloth stretched over a floor of laths. Below this floor, at a distance of from 12 to 14 ft., is a fireplace in which smoke-

less Welsh coal (anthracite) is burnt. This fire heats the air, which, together with the products of combustion of the fire, passes upwards through the hops, and in doing so carries off moisture from the hops and so dry them.

Theory of Hop-Drying.—When water is exposed to dry air, the water gradually changes to a state of water-vapour and passes away into the air. Similarly, when hops are exposed to warm dry air, the moisture which they contain changes to vapour and the hops become dry.

The rate of drying chiefly depends:—(i) upon the temperature of the air, and (ii) upon the rate at which the air passes through the hops.

(i) The amount of water that a given volume of air can take up in the form of water-vapour is dependent upon the temperature of the air. If the air is cold, a given volume can take up comparatively little water-vapour, whereas, if the air is warm, the same volume can take up much greater quantities. Thus 10,000 cubic feet of dry air at a temperature of 60° F. can take up about $8\frac{1}{2}$ lb. of water as water-vapour before becoming saturated. If the temperature of the air is raised from 60° F. to 100° F., then 10,000 cubic feet can take up about 32 lb. of water-vapour before becoming saturated, *i.e.*, nearly four times as much. Consequently, hops dry much more quickly in a draught of hot air than in one of cold.

We have seen that air at 60° F. cannot contain so much water-vapour as air at 100° F.; if, therefore, air saturated with water-vapour at 100° F. be cooled to 60° F., some of the water-vapour is condensed, and a "mist" is formed which settles in the form of "dew." Under certain conditions, this state of affairs may occur during hop-drying, and, as it results in serious damage to the hops, it must be carefully guarded against.

(ii) The rate at which drying proceeds is proportional to the rate at which the air passes through the hops, or, as it is called, the strength of the draught. It is due to this factor alone, namely, the strength of the draught, that much larger quantities of hops can be dried upon oasts in which a strong draught is artificially produced by a fan.

Let us now examine what happens when, at the beginning

of drying, hot air begins to pass upwards through the load of hops spread out upon the "hair-cloth" in the oast. In contact with the bottom layers of hops, the hot air warms the hops and takes up water-vapour from them, and at the same time, by contact with the hops, the air is cooled almost to the temperature of the hops. The air, being thus cooled and nearly saturated with water-vapour, passes through the remainder of the hops without appreciably affecting these, and finally passes away through the top of the oast, carrying with it the water-vapour it has absorbed from the bottom layers of the hops.

As the bottom layers get dry, the hot air begins to act on those immediately above, and so the drying proceeds through the whole depth of hops, the top layers being the last to get dry.

At the beginning of drying, the fires are kept low, so that the temperature of the air passing through the hops is also low. Should the temperature of the air become too high, either from too fierce a fire or from too slow a draught, the air absorbs so much water-vapour from the lower layers of hops that, as it is cooled by its passage through the hops, the air becomes supersaturated, and the excess of water is deposited like dew upon the top layers of the hops. This deposition of water upon the top layers of the hops is fatal, and results in the hops becoming "reeked" and spoilt.

In order to prevent this "reeking," it is essential that a good draught be established within the oast, so that the air may pass rapidly through the hops, and thus, being in contact with the fires for a shorter time, the air may not become too hot. As drying proceeds and the hops upon the "hair-cloth" become lighter through loss of water, they offer less resistance to the draught, and consequently the latter continually improves.

In those oasts in which the draught is artificially produced by means of a fan, such a draught can be readily obtained at the beginning of drying, but this is far from being the case in the common open-fire kilns, in which the dryer is dependent upon the "natural" draught.

The strength of the draught is dependent upon a variety of factors, which may be classified as follows:—

(i) *Temperature of the Air.*—The strength of the draught depends upon the difference in temperature between the air inside the oast and the air outside the oast. If the air outside the oast is nearly as warm as that within the oast, the draught will be weak, whereas, if the air inside is very hot and the air outside cold, then the draught will be strong. The temperature of the air outside the oast cannot be controlled, and, therefore, the hotter the air inside the oast the greater will be the draught. It must be remembered, however, that very hot air must not be allowed to pass through the hops at the beginning of drying because of the danger of "reeking" them.

(ii) *Height of Oast.*—The strength of the draught is proportional to the height of the column of air that produces the draught, thus, there is a better draught in a tall oast than in a low one. It is for this reason that factory chimneys are built so high. In an oast it is important that the height of the oast, both from the floor to the hair and from the hair to the cowl, be great, since the hot air in both parts influences the draught.

(iii) *Strength of Wind.*—If a strong wind is blowing there is seldom any trouble in obtaining a good draught, provided that the cowl is pointing in the right direction.

If the air is still and foggy, much greater difficulty is experienced in obtaining a draught, and under these conditions it is most important to have the cowl pointing away from whatever wind there may be, otherwise, the least bit of wind blowing into the cowl is sufficient to stop the draught and spoil the hops.

TEMPERATURES OF HOP-DRYING.—The temperature at which hops are being dried can be easily controlled by the use of a thermometer. The thermometer should be placed so as to register the temperature just below the hops, *i.e.*, the point at which the hot air first comes in contact with the hops.

There are various kinds of thermometers in use for Hop-Drying. One very useful kind of thermometer is described in a leaflet * published by the South-Eastern Agricultural College. It consists of an ordinary thermometer fixed to a wooden rod; this is pushed into a hollow iron rod, which is

* *The Temperatures of Hop-drying.* Price 1*d.*

perforated with holes. When the hops are loaded the iron rod is pushed through a hole in the door of the oast so that the rod lies on the hair just below the hops. The wooden rod and thermometer lie in this iron tube, and can be pulled out and read when desired.

The above-mentioned pamphlet also gives a very accurate account of the manner in which the temperature should be regulated during the drying process:—

At the beginning of drying the temperature should be between 80° F. and 100° F. It should rise gradually and steadily to 140° F. during the first three hours, provided there is a good draught. If the draught is poor, there must be a slower rise in temperature, and four or five hours must elapse before a temperature of 140° is reached. From this point, when the bulk of the "reek" will have passed off, the temperature should be kept steady for about five hours, during which time it may be allowed to rise to between 150° F. and 160° F., but must not exceed the latter temperature. Finally, when the hops begin to finish, the temperature should be allowed to fall somewhat, to a final temperature of about 120° F. The object of this last fall in temperature is that the hops may finish more slowly, and hence more regularly.

PRACTICAL DRYING.

Preparation of Oasts.—The oasts should be thoroughly overhauled and put in repair a week or ten days before picking, and at the same time the hairs, which are taken up during the winter, should be stretched and nailed down.

Loading.—An oasting of hops can usually be dried in from 9–12 hours, so that two oastings of hops can be conveniently dried in each 24 hours.

The hops that are picked in the morning are loaded as soon as they arrive at the oasts, whilst those that are picked in the afternoon are stored in some well-ventilated place, usually a "green loft," from which they can be carried straight into the oast. These are loaded upon the kilns as soon as the morning's oasting is dry. The night's oastings, in sultry weather, tend to heat in the bags, and the hops become discoloured; to prevent this, the bags should be untied and stood up, so that air can circulate about them.

In loading the oast, care must be taken to spread the hops lightly and evenly over the "hair"; lightly, so that the hops may offer as little resistance as possible to the passage of the draught, and evenly, so that the fire may dry all the hops regularly, and not leave patches of undried hops where the hops lie thicker.

The depth to which hops may be loaded upon a kiln depends upon the ripeness of the hops and upon the draught obtainable in the oast. If the hops are ripe and there is a good draught, they may be loaded to a depth of 10 or 11 in.; this is equivalent to three-quarter bushel of hops per square foot if "good measure" is taken by the booker. In the case of Fuggles and other very large hops, the depth may be even greater. If the hops are not fully ripe or if the draught is bad, smaller quantities should be loaded.

The operation of loading should be carried out quickly, so that the walls and roof of the oast cool as little as possible during the operation. The draught always starts better in a warm oast, because the air is warmed instead of being cooled by contact with the walls. For the same reason a good fire should always be lighted in an oast a few hours before hops are to be dried, and especially before the first oasting of the season.

Turning.—In order to hasten drying, it is usual to turn the hops one or two hours before the finish. The actual time at which the turning is done is determined by the state of the hops. The bracts are the first part of the hop to dry; when these are dry and the hot air begins to act on the strig, a marked change takes place in the hop—the bracts all open out and the hop is said to have "feathered," since it presents a resemblance to the plumage of a bird in frosty weather. Finally, as the strig dries, the bracts close up again. The time at which the hops are turned is when the top layers of hops are well "feathered," and the hops feel warm and dry to the touch. If turning is done before this, the top wet hops falling among the dry hops cause discoloration.

Finish of Drying.—It is somewhat difficult to determine the exact stage at which hops are dry. They must not be unloaded too soon or the hops will turn sour in the pocket;

on the other hand, if drying is continued too long, the hops break to pieces when unloaded. The best test is to take a good handful, and rub it in the hands; if dry, practically all the strigs should be brittle, and there should not remain more than two or three tough ones in the handful.

When drying is finished, open all the shutters below the hair, and let the hops cool as much as time will allow before unloading.

Management of Fires.—As soon as the hops are loaded the fires should be made up with big pieces of coal, so that they may burn steadily for four or five hours without further stoking. As the "reek" or moisture passes gradually off from the hops and the hops get lighter, the draught gradually improves. In consequence of this, the fires gradually burn faster and the temperature slowly rises.

It is of great importance that the temperature should be kept continually rising during the first four hours of drying, since, if it falls at any point during this period the colour of the hops is likely to suffer. Stoking the fire during the early part of drying should be avoided, as it causes the temperature to fall. If the temperature should be rising too fast it should be checked, not by touching the fire, but by letting in more cold air below.

During the latter part of drying the fire-bars should be kept free from ashes, so that the fire burns nicely, and there should be a moderate depth of coal on the bars. If the fire is too thin, very hot places are liable to occur in the fire, and there is a danger of burning the hops immediately above these bright places by radiated heat.

Management of Draught.—It is only very rarely that there is too much draught in an oast, so that the management is mainly concerned with maintaining a good draught. To attain this end, various precautions must be taken.

The oast must be warm before loading. The loading must be done as expeditiously as possible, and the drying started at once. There must be no leakage of cold air into the oast above the hops; therefore, the doors leading on to the hair must fit properly, and the tiles must be securely ceiled. In foggy weather, great care must be taken to keep the cowls in the right direction, pointing away from the wind.

Should the draught at any time be too fierce, as may happen towards the finish of drying, after the hops have been turned, it can be easily remedied by opening the door of the kiln above the hops; cold air will then be drawn in and the draught checked.

Sulphuring.—Sulphur is now universally burnt during the drying of hops in England. It was at one time thought that the sole value of sulphur in hop-drying was to improve the appearance of the finished sample by bleaching the hops. The use of sulphur is, however, advantageous in hop-drying for several other reasons. In the first place, the use of sulphur hastens the drying process considerably, so that both time and fuel are saved. Secondly, hops dried in the absence of sulphur retain a peculiar odour, resembling withered vegetable substance, due probably to some fermentation of the hops. If sulphur is burnt this odour is not present. Thirdly, it is believed by some brewers that the presence of the burnt sulphur helps to preserve hops which are to be kept for considerable periods before use.

The sulphur, in the form of Roll Brimstone, is usually burnt at about the rate of ½ lb. of sulphur to 10 bushels of hops. It should be burnt as soon as drying commences, in open pans rather than in the fireplace.

TYPES OF OASTS. *Open-Fire Kiln.*—The most common oasts in use at the present day are open-fire kilns (see Fig. 1), in which the products of combustion from the fire pass directly through the hops. These necessitate the use of high-quality anthracite coal, free from arsenic, for the fires.

The kilns are either square or round buildings, with brick walls and tiled roofs. The most convenient size for the oasts is from 16 ft. to 18 ft. square, or in diameter; if larger than this, there is some difficulty in levelling the hops accurately.

About 4 ft. from the top of the walls and about 12 ft. or 14 ft. above the fireplace, a wooden floor of joists (see *AA* in Fig. 1) is built into the walls, and upon this floor is stretched a cloth made of horse-hair, upon which the hops are spread out for drying.

The roof slopes upwards from the top of the walls to a circular opening about 3 ft. in diameter, and over this opening is fitted a cowl *C*, swinging upon well-oiled bearings in the

wind, so that the passage of the wind past the opening aids the draught, and also so that it prevents rain from falling on the hops. The height of the cowl from the hair should be as great as possible (from 16 to 18 ft.), and the roof itself

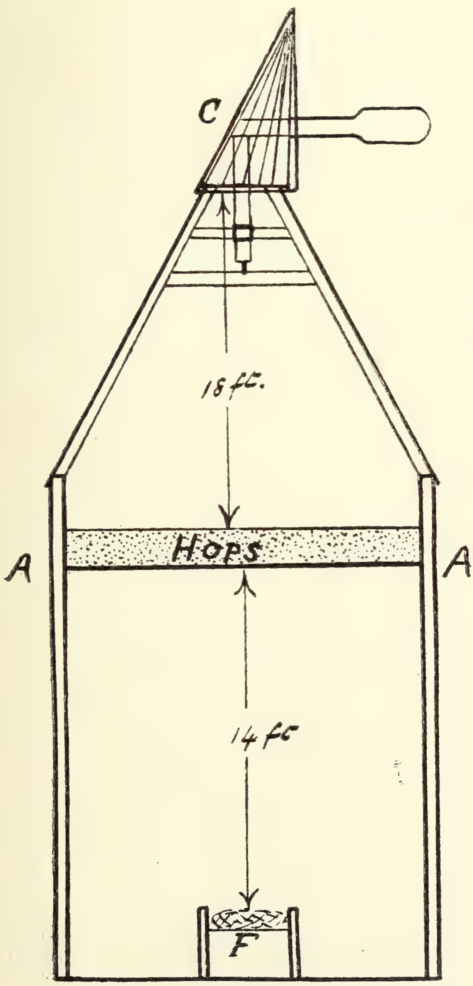


FIG 1.—HOP OAST.

F, fireplace ; *AA*, drying floor ;
C, cowl.

should be well ceiled with plaster, so that no cold air can be sucked into the oast above the hops and thus diminish the draught.

In the older types of oasts there are three or four small fireplaces in the centre of each oast, but in the more modern

oasts these have been replaced by a single larger fireplace, situated at one side of the oast. Provided the drying floor is sufficiently high above the fire, the latter arrangement is much superior; it entails less work, and the temperature can be more easily regulated. With a single fire, the distance between the fire and the hair must not be less than 12 ft., otherwise the hops are liable to be burnt. This latter possibility may be obviated by suspending a baffle-plate about 3 or 4 ft. above the top of the fire, or the fire may be carried just outside the oast and arched over with brick.

The fire is regulated by means of a blower; this consists of a large iron sheet suspended in front of the fireplace in such a way that it can be easily raised or lowered. By raising the blower, cold air is let into the oast above the fire and the fire is checked. By lowering, more air is caused to pass through the fire, which consequently burns more brightly.

The fires are further regulated by shutters round the bottom of the oast, by which cold air may be admitted at will.

Hot-Air or Stove Kilns.—One type of hot-air kiln, called the "cockle," has long been used in some parts of England. It consists essentially of a closed brick stove placed in the centre of the oast. The products of combustion do not pass through the hops, but are led through a brick flue up one side of the oast to within about 18 in. of the hair. At this point the flue divides, and the two branches are led horizontally round the walls of the oast, finally meeting on the opposite side, where they are connected with a chimney, through which the smoke and furnace gases pass outside the oast.

Cold air enters at the bottom of the oast; it is warmed by contact with the stove and flues, and eventually the "pure" heated air passes through the hops on the "hair."

In recent years several other types of hot-air kilns have been introduced. In most of these the brick stove has been replaced by an iron stove or furnace, and the products of combustion are led through a maze of iron flues inside the oast instead of the brick ones at the side of the oast. By means of these iron flues, the heat from the furnace gases is more completely transmitted to the drying air, and so an economy is effected.

The maintenance of a good draught in these hot-air kilns is as difficult as in the open-fire kilns. In order to overcome this difficulty, the more modern hot-air kilns are fitted with some apparatus for improving the draught by artificial means. These are of two sorts :—(i) Reek Dissipators; (ii) Fans.

Reek Dissipators.—These are contrivances by which hot air is led directly from the stove through a set of pipes, and delivered just above the hops. The air above the hops during the early part of drying is normally low in temperature, and hence does little to help the draught. The effect of the dissipator is to warm up this air by the admixture of hot air, and so improve the draught.

Fan Draught.—Fans have been used in hop-drying with the open-fire as well as with the stove kilns. The first to be used were exhaust fans, placed above the hops; these were not found to be perfectly satisfactory, because they caused the fire to come irregularly through the hops, so that the hops were dried unevenly. Blast fans, placed below the hops, are found to be more satisfactory in this respect, and are now generally employed with certain types of stove-kiln.

Advantages of the Stove-Kiln.—Since in these types of kilns the furnace gases do not pass through the hops, there is no possibility of the latter being contaminated either with the smoke or with arsenic from the fuel, hence the very expensive anthracite coal can be replaced by a cheaper form of fuel, coke or cheap coal, and thus economy is effected in the cost of drying. Against this economy, however, must be set the initial cost of the installation of the stove-kiln; and since the output of dry hops is not increased, the use of the stove-kilns, unaided by some artificially produced draught, presents no great advantage.

However, when a blast fan is associated with a stove-kiln, these systems do present considerable advantages. It has been shown previously that, by the use of a thermometer placed just below the hops, the temperature of the hops during drying can be accurately controlled. By the use of a fan the draught in like manner is brought under absolute control, and, therefore, the risk of reeking is reduced to a minimum.

Further, owing to the greater draught produced by the fan, much greater quantities of hops can be dried upon the

kiln, and the output of each oast can thus be approximately doubled. As a further result of this, the drying can be more easily controlled by the grower, since he will have fewer oasts to supervise.

The actual cost of drying per cwt. of dry hops is probably not materially affected. At the present time, owing to the great reduction of the hop acreage, there are sufficient open-fire kilns on almost all hop farms to dry all the hops that are grown, and, therefore, if the hot-air plants are installed some of the open-fire kilns will have to be shut up; consequently, the interest and depreciation of the plant, consisting of stove, fan, and engine to drive the fan, must be added to the cost of drying, and so neutralises the saving effected by the use of a cheaper form of fuel.

Should, however, the conditions be otherwise, and it be a question either of erecting a new oast or of installing a hot-air plant, then the latter alternative will probably be the more economical.

Cooling and Packing.—After the hops have been dried and cooled upon the kiln as long as time will allow, they are swept off the hair as carefully as possible, so that the hops may not be broken. Rolling-floors, by means of which the hops can be unloaded without any breakage of the cones, are sometimes fitted in the oasts.

The hops are still too hot for packing, and are usually left to cool from 8 to 12 hours, the time depending upon the dampness of the air. During the cooling the moisture in the hops becomes evenly distributed through the bulk, passing from the strigs of any partially dry hops to the crisp and drier bracts. At the same time, moisture is also absorbed from the air. The result of this is that the hops become tougher and can be packed with less breakage.

Should the hops have been unloaded before being perfectly dry, they will turn sour in the "pockets"; to avoid this they may be packed quickly so that they absorb no atmospheric moisture, or some hot well-dried hops may be mixed with them before packing. On the other hand, if the hops have been overdried, they must be allowed a longer time to cool, and to absorb moisture from the atmosphere.

Method of Packing.—For convenience in marketing, and

also in order that the hops may keep better, they are tightly pressed into cylindrical "pockets" or bags, 6–7 ft. long and 2 ft. in diameter.

In packing, great care must be taken to see that the hops in each pocket are uniform throughout. When parts of two or more oastings of hops are to be packed in the same pocket, they must be thoroughly mixed before packing begins; if this is not done, the pocket will be "streaky," and be rejected by the purchaser.

INJURY TO FOLIAGE BY BORDEAUX MIXTURE.*

E. S. SALMON, F.L.S.

Mycologist to the South-Eastern Agricultural College, Wye, Kent.

Although the use of Bordeaux mixture as a regular spray for apple trees to keep off fungus diseases has only lately been brought to the notice of fruit-growers in this country, it must be remembered that in other countries this wash has been in general use by the commercial grower for a considerable number of years. As Mr. Pickering has recently pointed out,† "Bordeaux mixture has practically superseded every other fungicide for general use, and two or three sprayings with it have become part of the annual routine of the fruit-grower in most countries except our own, whilst in viticulture its use is quite indispensable, and potato-growers are applying it more and more every year." It is not surprising, therefore, that there exists already in other countries a considerable literature on the subject of the effect of spraying with Bordeaux mixture in different seasons. On looking through this literature we find that in all the countries where Bordeaux mixture has been in general use for a number of years for spraying apples on a commercial scale, reports have been published from time to time recording the occurrence of a certain amount of injury resulting from spraying in certain seasons. Such injury has been termed variously "Bordeaux injury," "spray injury," "scald," "burning," "spray russeting," "cork russeting," and "yellow leaf," and has been reported from most of the apple-growing dis-

* See "The Making and Application of Bordeaux Mixture," *Journal*, Jan. 1910.

† *Journ. Agric. Science*, iii, 170 (1909).

tricts of North America, Europe, Australia, Tasmania, and New Zealand.

In this country the same kind of injury may occasionally be observed, and the following notes are given in the hope that they may prove of some assistance to growers who, while wishing to use Bordeaux mixture as the only proved remedy against apple "scab," and other fungus diseases, are anxious to take all possible precautions to prevent the trees being injured by this spray.

The injury which I have noted as sometimes following the application of Bordeaux mixture on apple trees becomes evident sometimes on the leaves and sometimes on the fruit. With regard to the leaves, these may show (1) local injuries in the form of brown spots which soon drop out, and, when the portions affected fall from the central part, give a "shot-hole" appearance to the leaf, while if the portions affected fall from the edges of the leaf, a jagged or notched appearance is given to the leaf, at first sight suggestive of the action of caterpillars; (2) a "scorching" of the edges or tip of the leaf, or the formation of brown patches which do not fall out; (3) a yellowing or browning of the whole leaf, which subsequently falls. In my experience the "shot-hole" effect on the leaves is the form of injury which results when a too heavy spraying is given, *i.e.*, when leaves are coated over with a *thick*, instead of a very thin, layer of Bordeaux mixture. The injury denoted by the yellowing or browning and subsequent fall of the leaf may follow after careful spraying with a properly prepared mixture, and seems to be dependent on unknown weather conditions. This form of injury occurs apparently only on certain varieties of apples.

As regards the fruit, this may sometimes show injury in that the apple becomes rough and "russeted," due to the formation of dead corky cells at the places where the action of the spray has caused a rupturing of the skin; in cases of severe injury the apple cracks. Or the effect of the spray (on young apples from a quarter- to half-grown) may be to produce unnatural blotches of a purplish colour on the sprayed portion. Both these kinds of injury are liable to appear only on certain varieties of apples. The "russeting" or "rusty" appearance is most marked in those cases—if,

indeed, it is not confined to them—where the trees are sprayed about a week or two after the fruit is set. I am inclined to think that the safest time to spray those varieties the fruit of which is liable to become "russeted" is immediately the bloom has fallen, or even in cases where the trees are flowering profusely, while a little of the bloom still remains on the tree. A later spraying is often necessary, especially with varieties (such as Ecklinville) which produce a considerable amount of fresh foliage during midsummer growth. If this fresh foliage is not sprayed, the "scab" fungus increases on the new (unsprayed) leaves, and spreads thence to the half- or three-quarter grown apples and without much affecting their growth in size ruins their appearance and keeping qualities by covering them with "black spots." A light spraying—just sufficient to protect the new leaves of the midsummer growth—at a time when the apples are about three-quarter grown, seldom, if ever, produces that serious "russeting" which may occur when the whole tree has been sprayed at the time when the apples are about a quarter-grown or smaller.

The actual causes which produce "Bordeaux injury" are still very obscure; it seems clear, however, that subsequent chemical changes in the Bordeaux mixture after it has been sprayed on the plant and there exposed to various weather conditions (especially wet weather) are largely concerned in causing the injury. The matter is complicated by the fact, recently discovered by Mr. S. U. Pickering, F.R.S.,* that the chemical compounds formed in Bordeaux mixture vary considerably according to the exact proportions of copper sulphate and lime used, and also according to the method of mixing them. Without considering here the complicated chemical questions involved—which are still unsettled—we may note the practical conclusions on the subject of this injury, and how it may best be avoided, which have been arrived at by horticultural authorities in the United States, after a long and careful investigation of the matter as it affects the commercial apple-grower in that country. The following notes are taken from Bulletin No. 287 of the New York Agricultural Experiment Station, written by Prof. U. P. Hedrick:—

"There are many anomalies of occurrence brought about, for

* See *Woburn Exper. Fruit Farm*, 8th Report, p. 7 (1908).

the most part, by weather conditions; as damage in some seasons, not in others; in some localities and not in others; some report dry seasons as favouring injury, others wet; some trees of a variety are injured more than others; the injury is sometimes most severe on the fruit and sometimes on the foliage; the fruit alone of some varieties is immune and of others, the foliage; the injury may appear in a few days or may not show for several weeks after spraying. Some varieties of apples are injured much less than others by Bordeaux mixture, and there is a wide range in this matter."

The practical suggestions given in this Bulletin to fruit-growers how to avoid the injury are as follows: (1) In spraying use less copper sulphate, give the 3-3-50 formula* for Bordeaux mixture a thorough trial. Spray in moderation; spray to cover the foliage and fruit with a thin film and yet not have the trees drip heavily. So far as possible the Bordeaux mixture should be used only in dry weather. Use equal amounts of lime and copper sulphate. (2) Some varieties of apples may be sprayed without much fear of injury. Others must be sprayed with great care. Distinguish between the varieties in spraying operations. (3) Many varieties of apples are nearly immune to attacks of the "scab" fungus. These need comparatively light applications of Bordeaux mixture in the average season. (4) Bordeaux mixture is the best fungicide known to the apple-grower. Its use cannot be given up in fighting the apple "scab," even though it cause some injury; apple scab causes a far greater loss than "Bordeaux injury."

It remains now to be considered to what extent these conclusions apply to apple-growing in this country. In the first place it is quite certain that we find in this country also that certain varieties of apples are susceptible to Bordeaux injury while others are not, although it appears that possibly this susceptibility may vary in different localities. In the season of 1908 I observed a case in the Maidstone district where the fruit of certain varieties which had been sprayed a few weeks after the fruit had set, showed injury in the form of abnormally coloured "blotches" on the skin of the apple,—these

* Equivalent to $3\frac{3}{5}$ lb. copper sulphate, $3\frac{3}{5}$ lb. quicklime, to 50 Imperial gallons.

varieties were Tower of Glamis, Lucombe's Seedling, and Ecklinville. Trees of the three following varieties, sprayed at the same time, showed no injury—Beauty of Bath, Wellington,, Newton Wonder. Last season the grower sent me the following notes: "The two sorts of apples which happened to be cropping with me were sprayed with Bordeaux mixture (made on the 4–4–50 formula) once before blossoming, and once afterwards at a time when the apples had formed. No damage was done to the leaf, but, as happened in the previous season, the apples on Lucombe's Seedling and Tower of Glamis were rather badly damaged, the fruit being small and very "russeted." I grew a large crop of Williams' Pears; here the leaves and the fruit were heavily sprayed with Bordeaux mixture,—in fact, we 'washed' the trees; no damage was done at all, and I have never grown previously such clean good fruit." In another district (Paddock Wood) it was noticeable last season that rather late spraying, *i.e.*, after the apples were formed, resulted in a large proportion of the fruit on the three following varieties becoming "rusty" or "russeted,"—Cox's Orange Pippin (badly affected), Bismarck, Beauty of Bath; while the following four varieties, similarly sprayed with Bordeaux mixture, showed no injury,—Lord Derby, Warner's King, Souring, Ecklinville. With respect to these latter varieties, the trees had produced in previous seasons very "scabby" crops, but last season, as the result of spraying with Bordeaux mixture, they bore a practically clean crop, and the spray did no damage to the fruit or foliage. Here, then, is a case,—and there are, no doubt, scores of similar ones, where it would pay the grower to distinguish between different varieties of apples in spraying.

In another case last season, a particular variety stood out conspicuously as resistant to "injury." In this instance it is possible that some of the Bordeaux mixture used was made with partly air-slaked lime, and on this account the mixture may have been specially injurious. Two sprayings were given to a considerable acreage of trees, and resulted in serious damage being done to practically all the trees of Lord Derby (on which the fruit was severely "russeted," and the leaves turned yellow), and of Cox's Orange Pippin (on which most

of the leaves were so injured that they fell), while trees of Potts's Seedling, standing among the Lord Derby, and sprayed with them, were unharmed.

Secondly, it is a fact that among English apples some varieties are immune, or at least resistant, to "scab." Such varieties are Bramley's Seedling, Lane's Prince Albert, Stirling Castle, Grenadier, Queen, the Victorian, and Golden Spire. Then, again, there are a number of varieties, such as Lord Derby, Beauty of Bath, Newton Wonder, Worcester Pearmain, Allington Pippin, which are by themselves but little liable to "scab," but become infested when the disease is rampant in their neighbourhood. When varieties of apples which are specially susceptible to "scab" as regards their foliage or young wood,—such as Cox's Orange Pippin, King of the Pippins, Ecklinville, Lord Suffield, Wellington, Bismarck, Lord Grosvenor, Summer Pippin,—are grown contiguous to those varieties which are partly resistant, the aim of the grower should be to keep the susceptible varieties clean by thorough and systematic spraying (treating with the winter-wash of copper sulphate solution those varieties whose young wood becomes "scab" infested).

In the case of Cox's Orange Pippin, which it is difficult to spray in summer without injuring, the aim must be to keep the surrounding varieties free from "scab" by spraying, and in this way avoid letting the "scab" invade the young wood of Cox's Orange Pippin, as it readily does if given an opportunity. It sometimes happens that a block of trees of Cox's Orange Pippin gets badly infested with "scab" by the planting up of young diseased trees (for, unfortunately, it is by no means rare for young trees of this variety to be sent out from English nurseries with the young wood badly infested with "scab"); in such a case regular applications of the winter-wash of copper sulphate solution will ultimately result in healthy wood being grown, when the chief source of the disease will be removed.

Thirdly, it seems certain that in any one season "Bordeaux injury" may occur in some localities and not in others. Some marked instances of this have occurred in Kent during the past season. For instance, it occurred in the districts of Maidstone, Paddock Wood, Southfleet and Longfield,

both "russeting" of the fruit and the yellowing and falling of the leaves being noticed as the result of spraying in several orchards or plantations in these districts. In other localities, in plantations where an equal amount of Bordeaux mixture, if not more, had been applied, no injury of any kind could be observed. For instance, on a fruit farm near Broadstairs all the apple trees, consisting of the following varieties, were very thoroughly sprayed twice with Bordeaux mixture made on the 4–4–50 formula: Golden Noble†, Ecklinville, Cox's Orange Pippin, Worcester Pearmain, Domino, Tom Putt†, Blenheim Orange, Benoni†, Wellington, Jacques Lebel, Cox's Pomona†, Allington Pippin†, Charles Ross, Royal Snow†, Glory of England†, Warner's King†, Betty Geeson†. No injury at all on the leaves or fruit of any of these varieties could be observed, while the fungicidal action of Bordeaux mixture had kept all the trees practically free from "scab," the value of the mixture in this respect being most marked in the case of those varieties distinguished by a †, since these in the previous seasons had borne very "scabby" crops.

Again, a grower from the neighbourhood of Canterbury wrote last autumn of his experience as follows: "I have no fault to find with the result of my spraying with Bordeaux mixture this season. Gladstone apples shed some of their leaves about a fortnight after the last spraying, but I am not at all certain if that was the result of the spraying; and Beauty of Bath and Cox's Orange fruits were a trifle rough, but I think that that was more to do with the weather than spraying. Bismarcks were most certainly improved by the Bordeaux; other varieties of apples I sprayed were Worcester Pearmain, Lady Sudeley, Cox's Pomona, Gascoigne's Scarlet, Lanes Prince Albert, Newton Wonder, King Pippin, Allington Pippin, and a few other varieties. All these showed no injury at all, and were all quite free from 'scab,' except in one small patch where they were not sprayed after the bloom had fallen, and there they showed 'scab.' I have come to the conclusion that Bordeaux mixture has done no injury to my apples this year, and that the most important times to spray are just before the flower buds open and about a week after the bloom has fallen."

In connection with this important subject of injury following the application of *properly*-made Bordeaux mixture, *i.e.* the occurrence of true "Bordeaux injury," it is necessary to emphasise the fact that caution is required in its investigation. The presence of injury (even though it be indistinguishable from true "Bordeaux injury") on sprayed trees must not be considered as evidence of the injurious action of the spray, unless "control" trees which have been left unsprayed show no such injury. Further, there are many causes at work—some of which are controllable, while others are not,—which produce injuries often exactly similar to "Bordeaux injury." Such injuries are being constantly confused with "Bordeaux injury."

In the first place, unless care has been taken to use only freshly-burnt quicklime (in lumps) in the making of Bordeaux mixture, a scorching of the leaves will certainly follow. The use by fruit-growers of mixtures made with partly air-slaked lime is unfortunately of common occurrence; such mixtures undoubtedly cause serious injury to foliage and fruit. Again, leaves already attacked by fungi will, when sprayed with Bordeaux mixture, show very pronounced injury. For instance, if leaves of an apple tree which are already covered with the "sooty" patches of the "scab" fungus (as shown in this *Journal* for June, 1908, Vol. XV., Figs. 2, 3, 4) are sprayed with properly-made Bordeaux mixture the portion of the leaf covered by the fungus will turn brown or blackish and soon die, or if the whole leaf is infected by the spawn (*mycelium*) of the fungus, it will become discoloured and will shrivel up. It is important for the grower to remember that he must get the Bordeaux mixture on to the leaves as early as possible each season, that is, before the fungus has spread to them.

But the commonest form of injury confused with "Bordeaux injury" is that caused by unfavourable weather conditions. Exactly what these weather conditions are is unknown. During the seasons 1908 and 1909 I have seen a considerable number of specimens of young apples (sent to me from districts in Kent, Surrey, Worcestershire, and Herefordshire) which were split or deeply cracked, and often more or less "rusty" or "russeted." These apples, which

were about a quarter grown, were supposed by the growers in some cases to be affected by the "scab" fungus; in other cases they were believed to be affected by "spray injury." Investigation showed that no fungus was present, and also that this injury occurred on sprayed and unsprayed trees alike. It seems that under certain unfavourable weather conditions—perhaps cold nights—soft-fleshed apples, such as Beauty of Bath, are liable to this injury.

During the past season two forms of injury to the leaves of the apple, due to unfavourable climatic conditions—possibly an excessive rainfall or, in some districts, low temperatures at night and cutting winds—have been much in evidence. The injury has consisted in (1) the whole leaf turning brownish and falling from the tree; or (2) the edges, or occasionally the tip, of the leaf, turning brown and curling or shrivelling, giving the whole tree (or sometimes only a branch or two of it) the appearance of having been badly scorched by a dangerous spray, or, where the injury was very severe, of having been injured by a fire lighted in its neighbourhood. In several instances this injury has been ascribed erroneously to the after-effect of Bordeaux mixture. In two cases where this kind of injury was very pronounced, investigation showed clearly that "weather conditions" alone were the cause.

In the first of these cases the plantation concerned was at Wye College; here the "scorched" appearance of many rows of apple trees was very noticeable last summer. Had the whole of such a plantation been sprayed with Bordeaux mixture, and no "controls" left, the conclusion would inevitably have been drawn by the practical man that the injury was due to the spraying. As it so happened, only 441 trees out of the 1,500 trees in this plantation had been sprayed. Consequently it was possible to compare sprayed with unsprayed trees. The facts were as follows:— The following eleven varieties were sprayed a few weeks after blossoming: Wellington, Bismarck, Duchess' Favourite, Warner's King, Newton Wonder, Cox's Orange Pippin, Blenheim, Stirling Castle, Ecklinville, Cornish Gilliflower, and Twenty Ounce. Some trees of Wellington and Cox's Orange Pippin, and all the trees of Blenheim and

Stirling Castle, were sprayed twice. By July 27th a large number of trees in the plantation showed a "scorched" appearance round the edges of the leaf, or extending over the greater part of the leaf; in severe cases whole boughs looked as though their leaves had been scorched by fire. In a few instances a single bough, or one or two boughs, showing this scorched appearance appeared on a tree, while the leaves on the remaining boughs were green and uninjured. Investigation showed that this injury was quite as pronounced on the unsprayed trees as on the sprayed trees. Some of the facts observed with respect to certain varieties are of interest. In one strip of the plantation a row of 94 trees of Wellington were sprayed; some of the trees subsequently showed the "scorched" appearance of the leaves described above; the same kind of injury, however, was much more marked on the two rows of trees, on either side, of Worcester Pearmain and Lane's Prince Albert, although these had received no spray. The injury was so severe on the Worcester Pearmains that the trees were weakened to such an extent that the apples never developed to their full size, but dropped off. In a row of 88 trees of Newton Wonder which were sprayed, no injury appeared except on the trees which crossed a plot of ground where a manurial experiment—under which the trees had been partially starved—had been carried on; here the leaves turned brown at the edges or ultimately died. This fact suggests that injuries due to climatic conditions are most liable to appear on trees that are not vigorous. Another variety which presented the "scorched" appearance to a marked degree and which had not been sprayed was Hoary Morning. The varieties which were sprayed and which showed no injury of any kind on the leaves were as follows: Ecklinville, Warner's King, Blenheim, Stirling Castle, Cornish Gilliflower.

Another very interesting case occurred in a plantation at Teynham, Kent. Here at the beginning of August last year a large number of trees of the varieties Beauty of Bath, Cox's Orange Pippin, King of the Pippins, Charles Ross, Allington Pippin, and Peasgood's Nonsuch showed exactly the same kind of injury as noted above in the case of the trees in the plantation at Wye College, the leaves being brown and dead at the edges or tip; while in one variety,

Duchess' Favourite, the trees had dropped most of their leaves and nearly all their crop. None of the trees in this plantation at Teynham had received any spray on the leaves. Taken all together, the trees were well grown and vigorous, had borne well in previous seasons, and not before shown this injury. One point was very noticeable: in all the varieties where the scorched appearance occurred, the injury was the more pronounced the weaker the growth of the tree. This again suggests that the unfavourable weather conditions, whatever they are—which appear to be the cause of this kind of injury, are withstood best by the most vigorous trees.

Conclusions.—In view of the fact that it is practically impossible in this country to keep any considerable acreage of apples free from "scab" or "black spot" without spraying with Bordeaux mixture, and that while the use of this mixture is being followed by complete success in many districts, in others "Bordeaux injury," to a greater or less extent, has followed the spraying, the fruit-grower should pay attention to the following details in spraying:—(1) Use a "Bordeaux nozzle," which throws a fine "misty" spray; spray the trees lightly, and leave off before the trees begin to drip. (2) Distinguish between the different varieties of apples, giving those which are liable to show "Bordeaux injury" a very light spraying with Bordeaux mixture made of 3 lb. copper sulphate, 3 lb. quicklime (in lumps), 50 gallons of water (mixed as described above); or spray such varieties experimentally with the lime-sulphur wash, described at p. 522 of Vol. XV. of this *Journal*. (Fruit-growers must remember, however, that although some success has lately been obtained in the United States with the lime-sulphur wash as a fungicide for use on tender-leaved fruit trees, it is unquestionably inferior to Bordeaux mixture as a general fungicide.) (3) Concentrate attention in spraying on those varieties whose leaves get "sooty" with the "scab" fungus and whose young wood gets "scab"-infested; varieties "resistant" to "scab" do not, as a rule, require to be sprayed. (4) Spray directly the blossom has fallen, and, where necessary, again when the apples are about three-quarters grown. (5) Use freshly mixed home-made Bordeaux mixture prepared from the best freshly-burnt quicklime (in lumps).

THE CONSERVATION OF THE FERTILITY OF THE SOIL*

A. D. HALL, M.A., F.R.S.
Director of the Rothamstea Experimental Station.

IN considering the value of various systems of farming it becomes a matter of prime importance to get some idea of how far the fertility of the land is being preserved, and whether the succeeding generation of farmers is likely to find the cropping power of the soil improved or deteriorated by the treatment it has received. It is pretty clear that in many parts of the world the natural riches contained in the virgin soils are being rapidly depleted; this may be deduced from the constant westward movement of certain classes of farmers in the United States and Canada, though in some parts of America the soil seems to be able to yield good crops for an indefinite period; on the other hand, many European soils have reached a sort of constant level of production, and get neither richer nor poorer, although they have been in cultivation for many centuries. We also occasionally hear of worn-out soils, but it would be more correct to say badly managed or spoilt soils, because there is no evidence that the productivity of a soil ever declines under suitable treatment.

In tracing changes in the fertility of soil, we may content ourselves with following up the changes in the amount of nitrogen present, because though phosphoric acid, potash, and lime are important factors in plant nutrition, these elements are not susceptible to the gains and losses from external operations like cultivation, by which the stock of nitrogen is so greatly affected.

There are various processes at work which will diminish or add to the stock of nitrogen in the soil, and these may be summarised as follows:—

(1) The growth of plants simply removes some of the nitrogen that has reached an available form, and if the crop is taken off at harvest, there is so much direct loss to the soil. As it may also be accepted that the plant itself, apart from bacterial action, neither converts any of the combined nitrogen it obtains into gas, nor brings into combination any of the free nitrogen of the air, there is neither gain nor loss

* An expansion of a paper by A. D. Hall and E. J. Russell read at the Winnipeg meeting of the British Association, 1909.

of soil nitrogen when the growth of the plant is returned to the soil.

(2) Various bacteria are capable of bringing atmospheric nitrogen into combination, and so increasing the stock of soil nitrogen. They may either live in symbiosis with higher plants (*Pseudomonas*), or exist free in the soil (*Azotobacter, Clostridium*).

(3) Another group of bacteria in the process of breaking down organic matter liberate the nitrogen in the free state, and so reduce the stock of soil nitrogen.

(4) Natural drainage waters contain nitrates which have been derived from the soil nitrogen by bacterial oxidation.

(5) The rain annually contributes a certain amount of combined nitrogen to the soil. The amount is greater in the proximity of towns; the average amount at Rothamsted is 3·84 lb. per acre per annum, and other results would show that this is a very representative figure for ordinary country air.

In practice most of these factors giving rise to gain or loss are at work together; which of them will predominate will depend upon the style of farming and cultivation the land receives. Some of the Rothamsted plots with their long-recorded history afford an opportunity of estimating the interplay of the various factors.

A. The simplest case to take is that of land under arable cultivation when nothing is restored to the soil. The unmanured plot on the Broadbalk wheatfield affords a useful example, and we have figures which show the change in its fertility between 1865 and 1893, a period of 28 years.

Broadbalk, Plot 3. Nitrogen, lb. per acre.

In soil, 1865.	In soil, 1893.	Loss in 28 years.	Added by rain.	Removed by crop.	Unaccounted for.
2722	2437	285	107	428	+36

In the first place it will be seen that the nitrogen in the soil declines when the crop is wholly removed and no manure is added, though the decline becomes slow after the first large loss of condition has taken place. It will be remembered that the yield of the unmanured wheat plot at Rothamsted fell off pretty quickly for a few years, but for the last fifty years has remained almost constant at an average of about 12·5 bushels per acre.

If we make out a balance-sheet and set off the nitrogen removed in the crop against that which the soil has lost, as

shown by analysis, together with that which has been brought down by the rain, we find that the soil contains about 36 lb. per acre more nitrogen at the end of the period than we should have expected. This quantity is too small to be significant; it would be more than covered by the experimental errors in the determinations; we may, therefore, conclude that the nitrogen required by the crop has just about been supplied by the soil and the rain. There must, however, have been other losses from the soil; a good many weeds are annually removed, and they contain some nitrogen; drainage water flows away containing, as we know by trial, some nitrates; there must also have been some bacterial liberation of nitrogen gas. These losses of nitrogen may not be large in the aggregate, but as there is no such falling off in the stock of nitrogen in the soil as would balance them, it follows that some recuperative agencies must have been at work in the soil restoring the stock of nitrogen. We know that *Azotobacter* and similar bacteria are present in this soil; we know also that there is a certain amount of weed of a leguminous nature growing every year among the wheat; these are the two sources of combined nitrogen which we may credit with the restoration of the stock of nitrogen in the soil.

However, their action is not sufficient to maintain the stock unimpaired, even in this impoverished soil, when the crops are wholly taken away.

B. We may now take another case, that of land very rich in organic matter and under arable cultivation, the crop as before being wholly removed. An example of this kind is afforded by the farmyard manure plot on Broadbalk, where 14 tons per acre of farmyard manure containing about 200 lb. of nitrogen are applied every year.

Broadbalk, Plot 2. Nitrogen, lb. per acre.

In soil, 1865.	In soil, 1893.	Gain in 28 years.	Added in manure.	Added by rain.	Removed in crop.	Unaccounted for.
4343	4976	633	5600	107	1361	−3713

Under these conditions the losses of nitrogen are enormous; of the yearly supply of nitrogen not quite a quarter has been recovered in the crop, and less than a quarter remains behind as an enrichment of the soil; more than half has been permanently lost through the destructive agencies enumerated above (3 and 4).

The production of this plot of land with its annual applica-

tion of manure greatly in excess of the requirements of the crop still tends to reach an equilibrium; after the first few years the crop does not increase any further, nor does the soil become any richer, because the agencies destructive of the combined nitrogen increase at an accelerating pace until they balance the greater intake of nitrogen. Of course, the equilibrium thus attained is at a much higher level of production than is attained on the unmanured plot, being an average of 38·6 against 12·5 bushels per acre for the last twenty years.

C. We may now take a case where the crop is not removed, but the whole of the vegetation is allowed to die down and fall back on the land. At Rothamsted portions of the Broadbalk and of the Geescroft fields have been allowed to run wild since 1881; they are covered with a rough natural vegetation, which on Broadbalk contains about 25 per cent. of leguminous plants, but on Geescroft is almost exclusively grassy. The vegetation is neither cut nor grazed by stock, and analyses of the soil after about 23 years had elapsed since the land had been under the plough show the following changes:—

Nitrogen, lb. per acre.

	In soil to 27 inches.		Added by rain.	Gain in soil per annum.
	1881–83.	1904.		
Broadbalk, 1881	5910	8110	88	92
Geescroft, 1883	6040	6980	80	41

The very remarkable gain of nitrogen in the soil of these two plots must be put down to the action of bacteria; on Broadbalk there are leguminous plants with which are associated the nodule bacteria, *Pseudomonas radicicola*, but that these are not the only or even the main agents in fixing nitrogen is seen from the gain of nitrogen in the soil of the Geescroft field, which is almost devoid of leguminous plants. The main factor has been the *Azotobacter*, the bacterium which fixes nitrogen when free in the soil, and its presence has been verified in the soil from both plots. The reason for its activity on these pieces of land lies in the fact that the yearly growth of vegetation is allowed to die back and fall on to the land. Thus the soil receives an annual contribution of purely carbonaceous material previously elaborated by the

plant from the carbon dioxide of the atmosphere, and by the oxidation of this carbonaceous material the *Azotobacter* organism derives the energy necessary to bring the free nitrogen gas into combination. In the laboratory *Azotobacter* must be supplied with sugar or similar carbohydrates and fixation of nitrogen will then take place to an extent that is proportional to the amount of sugar oxidised; in nature the requisite oxidisable carbohydrate is supplied by the debris of previous vegetation. We have seen that on the adjoining unmanured plot of Broadbalk from which the wheat is removed every year, fixation is so small that it only just balances the yearly loss of nitrogen due to drainage, &c.; fixation is kept down at this low level because, beyond the small root and stubble residue of the wheat plant, there is no carbonaceous material supplied for the *Azotobacter*. The much greater nitrogen fixation in the Broadbalk than in the Geescroft soil may be set down to the presence of a fair amount, 2–3 per cent., of calcium carbonate, a substance which is almost absent from the Geescroft soil, yet without it the *Azotobacter* cannot function properly.

It is to the activity of *Azotobacter* when thus supplied with carbohydrate by the annual fall of vegetation that we may attribute the accumulation of nitrogen in virgin soils. The higher plants alone, however long they might have occupied the land, could only restore what they had previously taken from the soil, and thus could originate no such vast stores of nitrogen as are found in the virgin soils like the black steppe soils of Manitoba and the North-West. This conclusion is strengthened by the fact that such steppe soils are always well supplied with calcium carbonate, a necessary factor in the action of *Azotobacter*. The organism itself has also been isolated from all such soils.

We are now in a position to see how far these various examples can be made to interpret the conditions which prevail in practice.

In the first place, it is clear that the growth of successive cereal crops which are wholly removed from the land will rapidly reduce the stock of nitrogen originally in the soil, not only by the amounts withdrawn in the crop, but also because of the oxidising actions which the cultivation sets up in the land. Moreover, the richer the land to begin with,

the greater will be the annual losses; when the land gets anywhere near the pitch of impoverishment represented by the Broadbalk unmanured plot, not only is the annual conversion from dormant into available plant food small, but the wasteful oxidation is similarly reduced, and the stock of nitrogen is only slowly depleted. If instead of cropping continuously with cereals a more conservative system of farming is introduced, in which leguminous crops become a regular feature in the rotation, and a certain amount of carbonaceous matter is returned to the land, as by the folding off of green crops by sheep, then the recuperative agencies fixing nitrogen become sufficient to repair the losses due to the crops and the waste by drainage and oxidation, and a moderate level of fertility may be maintained indefinitely without the introduction of any extraneous source of nitrogen.

Such, indeed, was the state of affairs in Europe prior to the discovery of artificial manures and foods; the farm had to be self-supporting, the nitrogen that came back to the land in the farmyard manure had all been taken from the land previously; it was less than that which left the land by the amounts in the corn, meat, milk, and wool sold off the farm, and by all that was lost and wasted in making the farmyard manure. These losses were, however, so far balanced by the gains of nitrogen due to bacterial agencies that the fertility of the soil at its low level remained unimpaired; *e.g.*, there is evidence that the average production of wheat in the south and east midlands of England had remained at about 20 bushels per acre for a long period up to the early years of the nineteenth century. That the land can attain such an equilibrium of production and fertility is indicated by some of the results obtained on the Agdell Field at Rothamsted, where a four-course rotation of swedes, barley, clover or bare fallow, and wheat is followed. The experiment started in 1848, and since that time the soil has been analysed in 1867, 1874, 1883, and 1909. For our purpose the instructive plot is that which receives no nitrogen as manure, but minerals, *i.e.*, phosphoric acid and potash, once in each rotation; it is divided into four sub-plots, two on which clover (or beans) is grown before the wheat, two on which there is a bare fallow; one each of these two again has the swede crop returned to the land, whereas on the other it is carted away.

The following table shows the percentage of nitrogen in the surface soil (9 inches) at the respective dates, together with the average crops on each plot over the period 1852–1903.

Nitrogen per cent. in Soil of Agdell Field, Rothamsted.
The plots all receive mineral manures, but no nitrogen.

	Fallow.		Clover.	
	Roots carted off. 13/14.	Roots returned. 9/10.	Roots carted off. 15/16.	Roots returned. 11/12.
1867	0·1224	0·1240	0·1327	0·1380
1874	0·1147	0·1238	0·1241	0·1321
1883	0·1161	0·1228	0·1329	0·1383
1909	0·1159	0·1195	0·1347	0·1498
1852—1903				
Wheat average ...	31·2 bushels	32·2	32·2	35·1
Clover ,, ...	—	—	41·0 cwt.	47·7
Swedes ,, ...	151·0 cwt.	268	160	187
Barley ,, ...	22·1 bushels	28·7	24·5	34·5

The changes indicated in the amount of nitrogen in the soil are not large, being, indeed, very close to the experimental error; but, reviewing the numbers altogether, it may safely be concluded that the first plot, 13/14, from which the roots are carted and where no clover is grown, is declining in fertility. The two plots 9/10 and 15/16 are practically stationary; if anything, 9/10 without clover may be losing ground, whereas 15/16 with clover, but from which the roots are carted, may be gaining ground; while the plot 11/12, on which both the roots are returned and clover is grown, is still more probably gaining a little fertility. This last plot has yielded on the average over 52 years 35 bushels of wheat, 34 bushels of barley, over 9 tons of swedes, and nearly 2½ tons of clover hay per acre, which is nearly equal to, if anything higher than, the average production of the whole of Great Britain during that period. Such a yield, which, though equal to the average, may be taken as lower than a good farmer would expect from that class of land, has been obtained without bringing in any external source of nitrogen, without even returning to the land all that would come back under ordinary conditions of farming. In practice it would not always be possible to feed off the root crop on the land,

and even then not so much carbonaceous material would be returned as is the case in the experiment, where it has been necessary to cut up the roots and plough them in, but, on the other hand, the manure made from the straw of both the wheat and barley crops and from the clover hay would also come back to the land.

The evidence provided by this plot is strengthened by the results obtained on the three other plots, on which the recuperative operations of clover growing, and returning the roots to the land, are either singly or together omitted; under such conditions the gross production is distinctly less, and the fertility of the land is stationary or declining very slowly, so that an equilibrium at a lower level of production has been or will shortly be attained.

We may then conclude from these Agdell Field results that a conservative system of farming on the four-course system, in which clover is grown at least once in every two rotations, in which the roots are consumed on the land, and the dung made by the straw and hay comes back to the land, will maintain the fertility of the soil and support for an indefinite period a gross production at about a 4 qr. of wheat per acre level without any necessity for importing nitrogen. The natural agencies of nitrogen fixation due to the growth of the clover crop and the bacteria depending on the supply of oxidisable carbonaceous matter returned to the soil are capable of restoring sufficient nitrogen to the land to balance such an output and to repair other unavoidable waste. Of course, such a conclusion deals with nitrogen alone; it assumes that the supply of phosphoric acid, potash, and calcium carbonate is adequate, and, indeed, on much British land the potash and calcium carbonate will be furnished by the soil, while 4–5 cwt. of superphosphate per acre for the roots will maintain or even increase the stock of phosphoric acid.

The 4 qr. of wheat per acre level of production is, however, a low one to aim at; although it is the actual average production of the country at the present time, it is below that which a good farmer expects to-day, and must, indeed, attain if he is to make a satisfactory profit on his land. But if the general level of production is to be raised from the 4 qr. of wheat to, say, the 5 qr. of wheat standard, then an external

supply of nitrogen will be required, either in the form of nitrogenous fertilisers for the root and wheat crops, or of purchased feeding-stuffs to enrich the dung. Nor will it be sufficient, and this is a very important point, merely to add as much nitrogen as is taken away from the land in the increased corn crops; we have to add enough to get the land into much higher condition, and this means greater wastage at every stage. We have seen in the case of the Rothamsted plot receiving dung how great the wastage becomes when a large amount of dung is put on the land every year, and though the losses in this case are excessive, they will always become greater at an ever-increasing ratio the higher the condition of the land. It is another example of the well-known law of diminishing returns; the first addition of manure produces the best effect; each succeeding application produces a smaller increase in the crop till at a certain point nothing further is gained, however much manure is put on.

We may conclude, then, that with every system of farming a certain position of equilibrium will be reached (viewed over a term of years long enough to smooth out seasonal effects) when the natural recuperative agencies and the additions of fertilising material in the manure are balanced by the removals in crops and stock and the inevitable waste. The higher the level of production, the greater will be the waste, and, in consequence, the additions of fertiliser must be doubly increased to maintain the balance. How high a level of production can be profitably maintained is determined by the prices that rule for the crops, but there will always come a limit when the production can be no longer increased by additions of fertiliser except at a loss; at such a stage it is only the introduction of improved varieties or some variation in the methods of cultivation inducing a better utilisation of the fertiliser which will still profitably increase the production per acre.

On examining the variations in farming systems in different parts of the country, it will be found that farmers do instinctively adapt their expenditure on fertilisers (including feeding-stuffs), and, therefore, their level of production to the magnitude of the returns they can get for their produce; one man will have a large cake bill and spend 40*s*. per acre on artificial fertilisers during his rotation; he can maintain

a high level of condition, and therefore of waste in his soil, because he can get good prices for potatoes or barley or sheep, whatever his staple product may be. But on poorer land and with less suitable markets a man may be driven to cut down his cake bill and spend only 10*s*. per acre on fertilisers, because his products are not valuable enough to compensate for the waste at the higher level of condition in the land. Thus the problem of what is a profitable manure for a given crop becomes a very complex one, and the biggest factor is perhaps the level of production at which the individual farmer can conduct his business remuneratively.

THE PEAR LEAF BLISTER MITE (*Eriophyes pyri*, Nalepa).

THE Pear Leaf Blister Mite (*Eriophyes pyri*, Nalepa) is a troublesome enemy of the pear tree, and seems to be on the increase. During 1908 and 1909, from May to September inclusive, specimens of the mites or galled leaves were sent to the Board from Sussex, Wilts, Devon, Somerset, Hereford, Shropshire, Norfolk, and Yorkshire. Theobald and Collinge in addition record cases in Bedford, Cambridge, Cheshire, Cornwall, Lincoln, Northampton, Surrey, Warwick, Worcester, and also from Wales. It is probably distributed over the whole of England, but it does not appear as an epidemic. Trees often remain unattacked in a garden, though in close proximity to badly infested trees.

Trees Attacked.—The Pear Leaf Blister Mite is an example of a species of *Eriophyes* which feeds on plants of different genera of the same Natural Order. According to Nalepa's list, it infests not only the pear, but also the following other British Rosaceous plants: Apple, White Beam Tree (*Pyrus aria*), Wild Service Tree (*Pyrus torminalis*), Rowan (*Pyrus aucuparia*), and the rare *Cotoneaster vulgaris*, but the Board's records refer to pear trees only.

The apple is very commonly attacked in America, as well as the pear. In Britain complaints relate chiefly to the destruction of the foliage of the pear, with the consequent effect on the fruit. Mite-infested pear leaves show characteristic raised patches or blisters (Fig. 2) with a minute opening on the under side. The raised patches or blisters are red, or green-red, or green, and later brown or brown-black.

In his Report for 1896 Theobald recorded direct damage by this mite to the young developing pear-fruits, blisters or galls in which the mites were present showing on the outside of the attacked fruitlets; these fruits were quite destroyed or remained stunted.

The Board have a similar record of such attack on pear-fruits. In this case the plant trained on a wooden paling about eight feet high had done well for some years previous to 1907. In 1907 this plant produced abundant bloom, but "when the pears were of the size of small peas, both leaves and pears showed attack, and all the pears but one dropped off. In 1908 the same thing again occurred, all the young pears dropping off."

Description of the Mite.—The Mite is minute. Nalepa's measurement is from 1/147 to 1/125 of an inch long. The magnified figure (Fig. 1) indicates the mite with its rounded body and elongated form. The anterior end of the body (cephalo-thorax) has on its upper surface a semicircular shield. In front is the rostrum with its piercing and sucking mouth parts. There are two pair of five-jointed legs; each leg ends in a claw with a four-plumed bristle. The abdomen is transversely ringed. On the upper surface of the mite, and springing from the hind edge of the shield, are two bristles. The abdomen bears towards its front end two bristles; about the middle are two moderately long bristles; near the hind end are two very short bristles; while there are two long bristles at the tail.

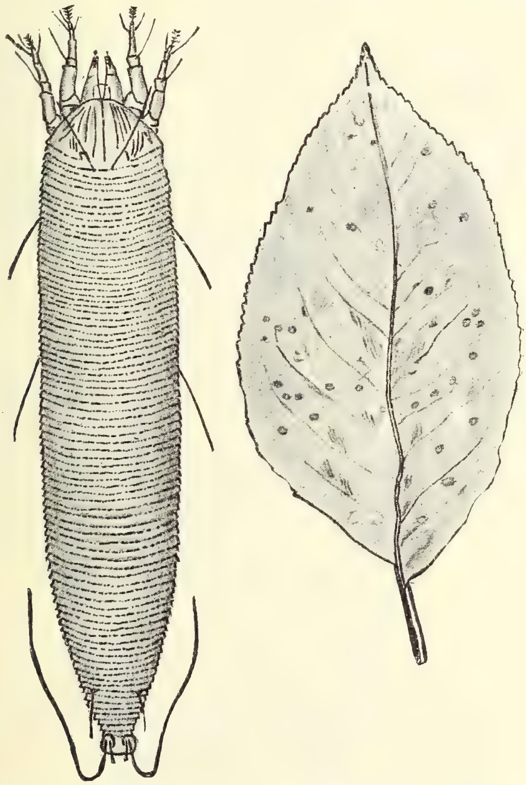
In the larval stage the mite resembles the adult in external appearance, except for the smaller size, a weaker bristling, and the absence of external sexual apparatus. In colour the mite is whitish.

Life History.—The winter is passed under cover of the outer bud-scales of the buds on the shoots of the year. In this position the mites shelter in numbers. In spring the mites proceed to gall the young leaves (Fig. 2). The adult female lays her eggs in the gall. New broods of mites spread from the galls, forming fresh blisters on the same and other leaves. Before leaf-fall the mites pass to their winter quarters in the buds.

Treatment.—1. Where attack is noticed before the mites

have spread, or where attack is on a small scale, the galled leaves should be collected and burned.

2. Spraying with paraffin emulsion when the leaves have fallen has been recorded as successful abroad. One correspondent of the Board did not find the measure effective, but a second correspondent found that a weak paraffin emulsion applied towards the end of May gave good results, and checked the spread of the pest.



PEAR LEAF BLISTER MITE (*Eriophyes pyri*, Nalepa.)
1.—The Mite (greatly magnified).
2.—An infested pear leaf, showing blisters caused by the Mites.

3. A correspondent of the Board writes: "The Pear Leaf Blister Mite has been prevalent in this garden for at least twenty years, but until 1907 no steps were taken to attempt a cure. Two large Marie Louise Pears on a wall were always badly attacked. In March, 1907, the trees were well sprayed with the Woburn Paraffin Emulsion,* with the

* See Leaflet No. 70 (*Winter Washing of Fruit Trees, and the Treatment of Neglected Orchards*).

addition of caustic soda. This practically cleaned the trees, only a few leaves being affected. This year—June, 1909—it has nearly disappeared." As March is dangerously late for the application of a caustic wash in most parts of England, those who adopt this treatment should treat their pear trees in January or February.

4. Experiments in America favour the use of a lime-sulphur-caustic-soda wash, the wash to be applied when the trees are dormant. Theobald's formula for this wash is:—

Lime	3 lb.
Flowers of sulphur	3 ,,
Caustic soda	1 ,,
Soft soap	1 ,,
Water	10 gallons

The flowers of sulphur should be made into a paste with water, and be poured over the lime. After boiling the mixture for a quarter of an hour, the caustic soda should be added; the whole should be allowed to boil for a short time, and then the dissolved soap may be added, bringing the water up to ten gallons.

5. There is no doubt that the pear leaf blister mite is distributed in young stock. Such nursery stock should, while in the dormant condition, be fumigated with hydrocyanic acid gas. (See Leaflet No. 188.)

EDIBLE FUNGI.*

BLEWITS (*Tricholoma personatum*. FIG. 11).

The cap of this variety is convex, it then becomes expanded, the extreme edge remaining incurved, smooth, and polished, dingy white or pale yellow, 3 to 4 inches across, flesh thick, white; gills crowded, dingy white; stem stout, bright lilac, the flesh is also tinged lilac.

It is found on grassy open places in autumn.

The flavour of this fungus is excellent, and it is one of the few kinds, other than the common mushroom, offered for sale in English markets.

Care must be taken to observe that the gills remain persistently white when the fungus is full-grown, as other fungi of a lilac colour, with deep rust-coloured gills, are not edible.

* Nos. 1–3 of this series of coloured plates and descriptions appeared in the *Journal* for February, 1910, Nos. 4–6 in March, 1910, and Nos. 8–10 in April, 1910. No. 7 (The Parasol Mushroom) was issued separately in February, 1909.

Fig. 11.—BLEWITS

(Tricholoma personatum).

FIG. 12.—FUNNEL MUSHROOM

(*Clitocybe maxima*).

FIG. 13.—AMETHYST AGARIC

(*Tricholoma nudum*).

FUNNEL MUSHROOM (*Clitocybe maxima.* FIG. 12).

The cap is distinctly funnel-shaped, margin incurved, smooth and even, bright yellow in colour, but sometimes quite pale, at others deeper in tint, 5 to 9 inches across, about four inches deep, flesh thick at the centre, gradually becoming thin towards the margin, gills narrow and crowded, whitish; stem 2 to 3 inches long, stout, coloured like the cap.

It occurs under trees, and often amongst grass in ridings in woods in autumn.

The flavour is excellent, but the fungus requires to be slowly stewed for a considerable time in a closed vessel.

A large, funnel-shaped fungus about the size of the above variety, but white in colour, and liberating drops of a white milky liquid when broken, should be avoided.

AMETHYST AGARIC (*Tricholoma nudum.* FIG. 13).

Every part of this fungus, when in vigorous growth, is amethyst or deep violet in colour, becoming more or less bleached when old. The cap is 3 to 4 inches broad, smooth and shining, often wavy, margin persistently incurved; gills narrow, crowded; stem 3 to 4 inches long, rather slender.

It occurs in the autumn, on the ground amongst leaves, often under trees, and generally grows in clusters.

It may be distinguished from certain purple or violet-coloured fungi that are not edible, by the absence of rust-coloured gills.

Official Exhibits at the Brussels and Buenos Aires Exhibitions.

Advantage has been taken of the occurrence in the present year of the International Exhibitions at Brussels and Buenos Aires to bring agriculture prominently to the notice of visitors by means of an official exhibit. At previous International Exhibitions the assistance given by the State has been chiefly confined to affording facilities to private exhibitors, and, apart from machinery, agriculture has usually received but little attention.

Brussels Exhibition.—On the present occasion, however, the Royal Commission for the Brussels Exhibition appointed a Committee of leading agriculturists, on which the Board

of Agriculture was represented, and this Committee have not only assisted individual exhibitors, but have themselves prepared an exhibit which should do much to encourage the export of pedigree live stock to the Continent.

As it was obvious that it would be impossible to show live stock in an Exhibition that would remain open for six months, the Committee determined to ask the Breed Societies to co-operate with them in the organisation of a pictorial exhibit composed of large photographs of typical animals, with short descriptions in three languages of the chief merits of the different breeds.

The Committee received a very satisfactory response from the Breed Societies, and as a result the following Societies are represented in the Exhibit.

Cattle.

Aberdeen Angus Cattle Society.
Ayrshire Cattle Herd Book Society.
English Jersey Society.
Hereford Herd Book Society.
Highland Cattle Society.
Red Poll Society.
Shorthorn Society.
Dairy Shorthorn Society.

Sheep.

Border Leicester Sheep Breeders' Association.
Hampshire Down Sheep Breeders' Association.
Oxford Down Sheep Breeders' Association.
Shropshire Sheep Breeders' Association.
Southdown Sheep Society.
Suffolk Sheep Society.

Horses.

Clydesdale Horse Society.
Hackney Horse Society.
Shire Horse Society.

Pigs.

British Berkshire Society.
National Pig Breeders' Association.

The method of arrangement will be seen from the accompanying plate, and it is thought that these large photographs and descriptions will undoubtedly attract much attention from

agriculturists visiting the Exhibition. Following on this, arrangements have been made for breeders and breed societies to provide advertisements and books for distribution, so as to supply the prospective buyer with the information necessary to enable him to get into touch with the British breeder. The whole exhibit has been placed in charge of a representative who will give information and advice to visitors.

The Committee were able to secure for the Exhibit an excellent position in the British Section, and it was placed in position ready for the opening on the 23rd of April last.

Buenos Aires Exhibition.—The International Agricultural Exhibition at Buenos Aires did not come within the scope of the Royal Commission, but the Board of Agriculture, in view of the very important agricultural interests concerned, determined in conjunction with the Board of Trade to send an Agricultural Exhibit to that Exhibition, which opens in June next.

The exhibit includes (1) an exact duplicate of the collection of photographs of breeds of British live stock which is being shown at the Brussels Exhibition; (2) a collection of photographs, diagrams, and mounted specimens to illustrate the recent progress made by agricultural education and research in this country; and (3) a collection of samples of the principal cereal and other seeds grown in England.

British live stock is so well known in Argentina that the display of photographs of celebrated pedigree animals will undoubtedly excite the interest of agriculturists, who it is anticipated will visit the Exhibition from all parts of South America. The Board, however, also attach much importance to the educational exhibit, as they are of opinion that in view of the excellent educational facilities which are now available in this country, efforts should be made to induce the sons of Argentine farmers and stock-owners to attend the agricultural colleges of Great Britain. The knowledge which they would acquire in this way of British live stock and machinery would be likely indirectly to promote the trade in these and other products.

The Board of Agriculture have appointed Señor Don Miguel de Hoz to be an Honorary Commissioner to represent the Board at the Exhibition.

Handbook of Live Stock.—In addition to these agricultural exhibits the Board of Agriculture and Fisheries have also caused a handbook, descriptive of the principal breeds of British live stock, to be prepared and translated into French, German, and Spanish for distribution at these Exhibitions.

The object of this handbook is to give an account of the principal characteristics of all the British breeds of horses, cattle, sheep, pigs, and poultry, with a brief history of their origin, and of some of the principal animals which have formed the foundation stock of the pedigree animals of the present day.

A statement of the more important Shows and places at which the animals of each breed can be bought, together with an indication of the average prices, is given for the information of prospective purchasers, while for further particulars, and for the names of individual breeders, they are referred to the secretaries of the breeding societies, whose names and addresses are also given.

The Board are indebted to Professor Wallace, of Edinburgh University, for the portion of the handbook relating to horses, cattle, sheep, and pigs, and to Mr. Edward Brown, of the National Poultry Organisation Society, for the portion relating to poultry.

The handbook is illustrated by some ninety photographs of animals of the different breeds, and is being sold at the Exhibitions at a price equal approximately to 6*d*.

Copies are not at present available, but the book will shortly be placed on sale in this country, price 1*s*.

Importation of Pedigree Live Stock into Argentina.

According to the *Review of the River Plate* (February 25th, 1910), the number of pedigree stock imported into Argentina during the past four years are officially returned as follows:—

	1909.	1908.	1907.	1906.
Cattle—Shorthorn	655	645	1,219	2,180
Hereford	24	27	46	93
Jersey	12	12	16	23
Various	83	56	62	144
	774	740	1,343	2,440

Photographs of British Live Stock at the Brussels International Exhibition.

	1909.	1908.	1907.	1906.
Sheep—Lincolns	1,332	1,765	3,551	6,555
Rambouillet ...	32	14	98	41
Shropshire... ...	92	59	244	299
Hampshire... ...	87	60	114	412
Various	367	325	305	495
	1,910	2,223	4,312	7,802
Horses—Racers	279	197	219	302
Clydesdale ...	35	76	146	210
Hackney	47	62	40	100
Yorkshire... ...	3	11	7	9
Various	204	419	382	521
	568	765	794	1,142
Pigs...	82	542	941	313

Rye Straw for Harness Making.

The Board are informed that some difficulty is experienced from time to time in obtaining home-grown rye straw suitable for harness-making, thatching, and mat-making, with the result that considerable quantities of rye straw are imported from the Continent.

The straw for these purposes needs to be specially prepared by combing, and for collar-making it must be of a suitable length, according to the size of the collar required. Rye straw for the latter purpose is principally imported from the North of France, though some is imported from Belgium and Holland. It is hand-thrashed and combed, and made up in 2-cwt. bales. This rye straw is stouter and tougher than the English straw, but its most important characteristic as compared with home-grown straw is its length, which is 5 feet and upwards. For the largest collars it is essential that foreign rye straw be employed, as English-grown straw is not long enough. A firm of straw dealers informed the Board that for these reasons they never obtained any rye straw for collar-making in Great Britain. In another case, however, specially grown English straw was found satisfactory.

One firm, who use about 150 tons of home-grown rye straw per annum, state that they find it increasingly difficult to obtain straw suitable for their purposes. They consider that the practice of manuring the rye, though increasing the grain crop, has led to deterioration of the straw.

It would seem from the information the Board have been

able to obtain that there is an opening for a small trade in this product, but it is necessary that attention should be given to securing a variety with longer and stouter straw than that commonly cultivated, while when produced the straw would need to be hand-thrashed and combed, and packed and tied uniformly. In November of last year the difference in price between imported rye straw intended for collar-making and rye straw used for other purposes was some 30*s*. per ton, but this difference is not constant, and foreign rye straw was then very scarce. In February of the present year it would appear that Belgian straw could be put on rail in London at £4 5*s*. per ton, while English rye straw, not combed but in trusses, was £3 2*s*. per ton. Occasionally the prices approach one another very closely. A suitable straw, long, hand-thrashed, combed, and uniformly packed, might, possibly, be expected to realise £1 10*s*. per ton more than the ordinary straw.

Some indication of the type of straw which is required in order to compete with the imported produce may be gathered from the following description of the straw produced in the North of France:—

In the Departments of the Pas de Calais and the Nord, a considerable portion of the cereal crops is thrashed by hand because the small producers have not sufficient material for a thrashing machine, and also because it is cheaper to employ hand labour, which is available throughout the winter. The principal reason, however, is because the straw which is thrashed by hand is a very much more remunerative article than if it is machine-thrashed. This applies particularly to rye straw, and to such an extent that many large farmers who could easily hire, or even own, a thrashing machine, frequently have all their rye thrashed by hand. The rye in question grows luxuriantly under the favourable conditions prevailing in this district, and has a very strong stem, which frequently exceeds five feet in length.

The straw is placed on the local market in various forms. It may be (1) machine-thrashed, or (2) hand-thrashed; and hand-thrashed straw may be (*a*) combed, (*b*) uncombed, (*c*) pressed into bales with the thin end of the sheaves turned in, (*d*) straight pressed, *i.e.*, entirely unbroken, or (*e*) manufactured in various forms, *e.g.*, stitched into mats, &c.

The straw is combed in a very simple way, frequently merely with the hand, or with a very short-handled wooden rake, which is passed several times through the butt end of the sheaf; or the sheaf may be taken by both hands and pulled several times through a row of wooden prongs which, pointing upwards, are firmly fixed to a trestle about four feet in height. The same result is obtained by each method, *i.e.*, the loose sheaths or leaves which surround the stem are removed, as well as any weeds, &c., which may have been cut and bound with the sheaf.

The Food of Rooks.

A valuable inquiry into the feeding habits of the rook has been carried out on behalf of the Council of the Land Agents' Society by Mr. Walter E. Collinge, M.Sc. The method adopted was to obtain specimens as far as possible from every county in England and from Wales throughout the year 1909. Correspondents were asked to forward one bird every fortnight, and the number actually received was 631 from in all 41 counties. The specimens were examined as received to ascertain the contents of their stomachs.

It has generally been supposed that the food of the rook consists very largely of beetles, insect larvæ, and earthworms, but the bulk of the food taken from the gizzards of the 631 rooks recorded in this report consisted of grain. Wheat and other grain was in the greatest abundance, and occurred in 320 cases. Other seeds were found only in 39 cases, while remains of fruit (mainly acorns, but in a few instances red currants and gooseberries) occurred in 84 cases. In 36 cases only were roots present, and in 80 per cent. these were grass roots, the remainder being potatoes.

Mr. Collinge remarks that, throughout the inquiry, he was astonished at the little animal food found in the gizzards. It averaged in the twelve months only 15 per cent. of the total food contents of the gizzards. In 116 cases, beetles or their larvæ were present, dipterous larvæ in six cases, larvæ of lepidoptera in 15 cases, aphidæ, &c., in one case, millipedes in six cases, and other insects (bees or wasps) in seven cases.

In addition to the 631 specimens received during 1909,

results were available from 141 specimens examined by Mr. Douglas T. Thring at intervals of a few days throughout 1908, in addition to the records of 58 specimens previously dissected by Mr. Collinge. A summary of the results from these 830 birds showed that 67·5 per cent of their food consisted of grain, 3·5 per cent. of seeds, fruit, roots, and miscellaneous vegetable matter, 15 per cent. of wireworms and other insects, 10·5 per cent. of earthworms, and 3·5 per cent. of miscellaneous food (eggs, young game, field mice, &c.). There is ample evidence, therefore, to show that with the present large numbers of rooks a grain diet is preferred, and also, so far as this inquiry goes, that the rook is not a particularly beneficial bird to the agriculturist, although its usefulness might be considerably increased were it fewer in numbers. The recommendation, therefore, which Mr. Collinge makes is to the effect that land agents and others should at once proceed systematically to reduce the existing number and to hold it in check.

Experiments with Calcium Cyanamide and Nitrate of Lime.

The supply of artificial nitrogenous manures has been increased during the past year or two by the introduction on a commercial scale of the two new fertilisers, viz., nitrate of lime and calcium cyanamide. Articles on the use of these manures have appeared in the *Journal* from time to time, and the results of a number of experiments have been included in the monthly summary.

The general tendency of the results obtained seems to be that the effectiveness of the nitrogen contained in nitrate of lime or in calcium cyanamide is approximately equal to that of nitrate of soda or sulphate of ammonia, but that on certain soils the lime which the new fertilisers contain gives them an advantage, and may make either of them more suitable. Thus in experiments carried out by the Royal Agricultural Society at Woburn, in which a comparison was made between sulphate of ammonia and calcium cyanamide as a top-dressing for barley, the results were greatly in favour of the cyanamide. The Woburn soil, however, is decidedly deficient in lime, and the better crop obtained was attributed in a large measure

to the presence of this substance in the cyanamide. In the experiments at Rothamsted (*Journal,* March, 1910, p. 1006), on the other hand, the lime gave it no advantage.

These conclusions are confirmed by the experiments carried out in Scotland by Mr. James Hendrick * under ordinary farming conditions over the four years 1905–8 on fields which were being cropped with cereals in the ordinary way.

The plan adopted was to have a series of plots manured with equal amounts of nitrogen, but one plot got the nitrogen in the form of nitrate of soda, another in the form of sulphate of ammonia, another as nitrate of lime, and others as cyanamide. All the plots received equally a dressing of a phosphatic and of a potassic manure, to ensure that the crops on none of the plots suffered from any deficiency of these two essential manurial constituents. There were two other plots in every case, one of which received no manure while the other received a dressing of the phosphatic and potassic manures only. The first of these served to show the capacity of the soil without any manure and the other its capacity without any nitrogenous manure but with a liberal supply of phosphatic and potassic manure.

The manures used were all analysed, and the amounts of the different nitrogenous manures applied were calculated from the analysis so as to supply an equal dressing of nitrogen per acre to each plot. The quantity was approximately equal to 1 cwt. of sulphate of ammonia. The percentages of nitrogen were as follows :—

	Percentage of nitrogen.			
	1905.	1906.	1907.	1908.
Nitrate of Soda ...	16·12	16·14	15·54	15·44
Sulphate of Ammonia	20·28	20·41	20·35	20·30
Calcium Cyanamide...	20·50	18·20	19·77	17·12 17·47
Nitrate of Lime ...	—	9·60	12·14	12·17

The general average of thirteen experiments carried out in three different seasons shows how little grain crops are increased by a supply of phosphates and potash alone. Plot 2 only gave an average increase of 64 lb. of grain and 1¼ cwt. of straw and chaff as compared with Plot 1. On the other hand, the addition of any of the four nitrogenous manures used gave a large increase in both grain and straw. The

* Aberdeen and North of Scotland College of Agric., Bulletin, No. 13.

largest increase was given by Plot 6, nitrate of lime, and amounted to 556 lb. of grain and $9\frac{3}{4}$ cwt. straw as compared with Plot 2. This was a very profitable increase indeed.

The average results were as follows, those for 1907 being given separately owing to the unfavourable character of the season, which affected the accuracy of the results.

Plot.	Manure.	Average of Experiments 1905, 1906, and 1908. 10 Oats and 3 Barley.		1907. Average of 7 Experiments. 6 Oats and 1 Barley.	
		Grain.	Straw and Chaff.	Grain.	Straw and Chaff.
		lb.	cwt.	lb.	cwt.
1	No manure	2196	$27\frac{3}{4}$	1957	$36\frac{1}{4}$
2	Superphosphate, 2 cwt. and Potash, $1-1\frac{1}{2}$ cwt.	2260	29	2250	$43\frac{3}{4}$
3	Do. and Nitrate of Soda	2595	$35\frac{1}{4}$	2308	$52\frac{3}{4}$
4	Do. and Sulphate of Ammonia	2668	37	2415	56
5	Do. and Calcium Cyanamide	2680	35	2225	$49\frac{1}{4}$
6	Do. and Nitrate of Lime	2816	$38\frac{3}{4}$	2315	$50\frac{1}{4}$
7	Do. and Calcium Cyanamide	2697	$35\frac{1}{4}$	2234	$53\frac{1}{4}$

The results from cyanamide are practically identical in grain with those from sulphate of ammonia, but sulphate of ammonia has a slight advantage in straw, while they are slightly superior in grain to those from nitrate of soda and practically identical in straw. In both cases, however, the difference is too small to justify any conclusions being drawn from it.

Nitrate of lime was used in only two seasons out of the three, but in both of these it gave results distinctly superior in grain to those of any of the other plots manured with nitrogen. In this case the results were very consistent throughout the experiments. In straw also the nitrate of lime had an advantage over any of the other manures. The superiority of nitrate of lime over nitrate of soda was distinctly shown throughout all the experiments, and was quite unexpected. Nitrate of soda is generally regarded as the most active of all the nitrogenous manures in ordinary use. Innumerable experiments in this and other countries have shown that on the average it will give for equal weights of nitrogen

a somewhat superior result to sulphate of ammonia, so that the fact that nitrate of lime has done better in these experiments than nitrate of soda must be attributed to the lime.

Nitrate of lime supplies lime as well as nitrate, whereas nitrate of soda does not, so that it may be assumed that the superior action of the nitrate of lime is due to the fact that the nitrate is combined with lime, which is a constituent generally deficient in soils of this type. Calcium cyanamide also contains a large percentage of lime, and this has no doubt contributed to the results obtained.

The main conclusions to be drawn from Mr. Hendrick's experiments are that calcium cyanamide (nitrolim or lime nitrogen) and nitrate of lime are active and effective nitrogenous manures. Calcium cyanamide proved equal to nitrate of soda or sulphate of ammonia as a manure for grain crops, while nitrate of lime was rather more effective, weight for weight of nitrogen, than nitrate of soda, sulphate of ammonia or calcium cyanamide. This was probably due to the fact that it contains lime in combination with the nitrate, and the results might be different on soils well supplied with lime.

No noticeable injury was caused to germination by applying calcium cyanamide at the time of seeding, so that there does not appear to be any necessity to apply this manure before the seed when it is used in dressings of about 1 cwt. per acre.

Both calcium cyanamide and nitrate of lime possess some disadvantageous properties which may limit their use, and neither of them is suitable for mixing with soluble phosphates. Nitrate of lime also absorbs moisture so readily that it requires to be protected from the air when stored, and is not suitable for use in ordinary manure mixtures.

The most suitable method of using nitrate of lime is as a top dressing. When so used its hygroscopic nature is an advantage, and taken in conjunction with the rapidity with which it works and its powerful forcing action, Mr. Hendrick thinks that it will be a most useful manure for such a purpose as forcing on a crop which is suffering from an insect attack.

The Council of the Surveyors' Institution have recently revised the conditions governing the scholarships which they have offered annually for the past four years. As in previous years one scholarship tenable at the University of Oxford and one at the University of Cambridge, each of the value of £80 per annum for three years, will be awarded annually. Election to these scholarships will be by competitive examination held annually at each university in June or July. Candidates must at the time of taking the scholarship examination have passed, or be entitled to exemption from, the First Public Examination of the University, or the examinations in stated and additional subjects in Responsions at Oxford, or the whole of the previous examinations of the University, including the Additional Subjects at Cambridge.

Scholarships awarded by the Surveyors' Institution.

The Surveyors' Institution also offer one scholarship of the value of £60 per annum and five of £50 per annum, tenable for three years at any university or affiliated college, other than Oxford and Cambridge, which may be selected by the candidate successful at the competitive examination and approved by the Council of the Institution. Scholars must have passed, or obtained exemption from, the whole of the Matriculation examination of their University. The competitive examination for these scholarships will be held annually at various centres, and conducted by independent examiners.

Further particulars may be obtained from the Secretary of the Surveyors' Institution, 12 Great George Street, Westminster, S.W.

Scottish Agricultural Organisation Society.

Although the Scottish Agricultural Organisation Society was started at a later date than its sister society in England, it has in the four years during which it has been in existence made equally rapid progress. Up to the end of 1908, 23 societies had affiliated to it, and during 1909 16 more were formed, making a total of 39.

The milk depôts are, it is stated, notably successful, and interest in this department of agricultural organisation is

growing rapidly. The Lugton and Dunlop Associations, formed under the Society's guidance, have substantially improved the price of milk in their respective districts; and their first year's operations show highly satisfactory profits after the cost of working and interest on capital have been met. Similar depôts have been completed at Rowallan, Fyvie, and Laurencekirk, and their progress is such as to offer every prospect of successful development. Associations for co-operative dairying have also been formed at Kilmaurs and Kilmalcolm.

The organisation of the poultry industry continues to make progress, both in the formation of new societies and in extension of the work of those already existing. The Executive Committee have co-operated with the Highland and Agricultural Society in the expenditure of that Society's grant of £50 towards the improvement of poultry in the Highlands, and they report that this expenditure promises to yield excellent results, and that the improvement of marketing organisation and the improvement of poultry breeding are processes mutually helpful to one another. Very substantial increases in the price of eggs have resulted from the Society's work in Orkney, in Lochaber, and in other districts.

Apart from these two special industries, the Report of the Society for 1909 states that the district Societies have been enabled to assist their members to obtain very substantial advantages, either in the price and quality of seeds, manures, feeding stuffs, implements, and other requisites, purchased or in the sale of produce. In almost every instance where district Societies have taken to buying collectively the agricultural seeds, manures, feeding stuffs, implements, &c., required by their members, an immediate effect has been not only a direct advantage to the members, but a considerable lowering of the prices quoted for these commodities by local traders and merchants; and on the other hand, wherever the produce, such as milk, or its manufactured products, eggs, and certain products of the fishing industry, such as crabs, lobsters, &c., have been collectively put on the market, higher prices have been obtained, with the effect of stimulating local traders also to offer increased prices for such produce. It is remarked, however, that there are too many farmers who are

content to take advantage of the benefits which the co-operative movement has conferred, without doing anything themselves to strengthen or help the work of organisation.

The Society has issued 18 leaflets, four of which are in Gaelic.

Co-operative Agricultural Societies in the United Kingdom.*

Co-operative production and distribution in the United Kingdom as applied to agriculture, which until recent years had been confined mainly to Ireland, has recently made considerable progress in Great Britain. The societies dealt with below are those registered under the Industrial and Provident Societies Acts, and the Friendly Societies Acts.

Productive and Distributive Societies.—While in the main the industrial co-operative societies are carried on and managed by the members as a means of improving their position as consumers, in the case of agricultural co-operative societies the main object is usually to enable the members more efficiently and profitably to carry on their daily occupation as individual farmers and producers. For this purpose the societies formed are of two kinds, which may conveniently be classed as "Productive" and "Distributive" Societies.

The "productive" societies take the form mainly of creameries or dairies, which purchase from the members the milk or cream produced by them as individual farmers. This is manufactured by the societies into butter, cheese, &c., by paid employees, and sold in the open markets, the operations of the societies being carried on under the supervision of committees elected by the members. In a few cases these societies have also undertaken the supply of members' requirements, to avoid the formation of a separate "distributive" society.

The "distributive" societies are usually formed for the collective purchase and distribution of the seeds, manures, implements, &c., required by the members, and for the sale in the markets of the cattle, eggs, poultry, and other products of the industry of the members in their capacity of individual farmers. The profits, as stated in the rules of both types of

* This article, which is based upon Returns made direct to the Board of Trade by the Societies concerned, and upon Returns made to the Chief Registrar of Friendly Societies and to the Agricultural Organisation Societies of England and Ireland, appeared in the *Labour Gazette* for April, 1910.

societies, are distributed among the members *pro rata* upon the value of the goods purchased from and sold to the society, but in practice are frequently added to the reserve fund.

In addition to these two groups of societies formed specially for agricultural purposes, there were, in 1908, 69 industrial societies (two wholesale and 67 retail distributive societies) which carried on farming and dairying departments mainly as a means of producing milk, butter, vegetables, &c., for the use of their members, the goods so produced being transferred to the distributive departments of the societies, and the profits, if any, being merged into the profits of the other departments and distributed in the general dividend to purchasers.

The returns relating to these three groups of societies, obtained by the Labour Department for the year 1908, showed that there were then at work in the United Kingdom 600 co-operative societies formed specially for agricultural production and distribution, with an aggregate membership of 79,468, a total share capital of £201,367; loan capital amounting to £199,817; reserve and insurance funds amounting to £145,119, and sales during the year amounting to £3,222,043, upon which, including interest on shares, a total profit of £33,958 was shown.

	Distribution.	Production.		Total.
	Agricultural Trading, Egg and Poultry, and Bee Keepers' Societies of all kinds.	Special Farming and Dairying Societies.	Farming and Dairying Departments of Wholesale and Retail Distributive Societies.*	Agricultural Distribution and Production by Societies of all classes.
	£	£	£	£
1898	296,125	486,317	228,514	1,010,956
1899	333,825	645,158	307,548	1,286,531
1900	380,535	811,302	397,366	1,589,203
1901	385,619	892,249	427,676	1,707,544
1902	440,786	1,039,431	478,534	1,958,751
1903	498,315	1,137,565	427,594	2,063,474
1904	532,913	1,132,087	401,383	2,066,383
1905	589,641	1,387,487	402,639	2,379,767
1906	841,900	1,683,238	473,258	2,998,396
1907	1,136,502	1,813,602	477,379	3,427,483
1908	1,292,503	1,929,540	494,889	3,716,932
Increase of 1908 over 1898 ...	996,378	1,443,223	266,375	2,705,976
Percentage Increase	336·5	296·8	116·6	267·7

* Including the productive department of one agricultural distributive society.

These societies employed 2,267 persons, and paid in salaries and wages during the year a total of £93,639.

Of these 600 societies, 298 were "productive" societies, employing 1,659 persons, and paying in salaries and wages during the year £65,460; their total sales amounting to £1,929,540 and their profit to £27,878; while 302 were "distributive" societies, employing 608 persons and paying salaries and wages amounting to £28,179; their total sales amounted to £1,292,503 and their profit to £6,080.

The farming and dairying departments of the 69 industrial societies and of one agricultural distributive society employed 884 persons, paid in salaries and wages during the year £46,877, and produced goods to the value of £494,889. The profit or loss on these departments was not shown.

The marked increase in the past three years is largely due to the development of co-operative agricultural distributive societies in England and Wales, resulting from the activities of the Agricultural Organisation Society assisted by the Board of Agriculture.

Cattle Insurance Societies.—In addition to the co-operative societies engaged in production and distribution there were, in 1908, 57 societies formed specially for the mutual insurance of the cattle, pigs, &c., belonging to their members.

Cattle Insurance Societies.	1904.	1905.	1906.	1907.	1908.
Number of Societies making returns	53	53	58	56	57
Total Membership	3,505	3,457	3,718	3,780	3,872
Receipts during Year:—	£	£	£	£	£
Contributions	1,369	1,457	1,758	1,665	1,641
Other Receipts	377	331	561	454	476
Total Receipts	1,746	1,788	2,319	2,119	2,117
Expenditure during Year:—					
Benefits to Members	1,375	1,242	1,760	1,539	2,088
Working Expenses	204	250	520	421	364
Total Expenditure ...	1,579	1,492	2,280	1,960	2,452
Total Funds at end of Year ...	7,210	7,491	7,899	8,091	7,868

These societies are registered under the Friendly Societies Acts without share capital, and consist mainly of small holders in agricultural districts of England and Wales.* The societies are distinguished from ordinary friendly societies in that the amounts of the insurances are not limited by the Act. In practice, however, the insurances are for small amounts only.

SUMMARY OF AGRICULTURAL EXPERIMENTS.†

EXPERIMENTS WITH CEREALS—*continued.*

The Composition of Oats (*Trans. Highland and Agric. Soc. of Scotland, Fifth Series, Vol.* 22, 1910).—In this paper Mr. James Hendrick discusses a number of analyses of different varieties of oats made by him in the years 1901–4, the main object being the comparison of old well-known Scotch varieties, such as Sandy and Potato, with new and foreign varieties. Most of the samples were grown in the northern counties of Scotland.

Proportion of Husk and Kernel.—In 1901–2, Sandy was the thinnest husked variety, and Storm King the thickest. Eleven old varieties contained on the average 20·56 per cent. of dry husk and 66·82 per cent. of dry kernel, while eleven new varieties contained 23·04 and 64·45 per cent. respectively. Some new varieties, however, such as Newmarket, Goldfinder, Waverley, and Banner, were quite similar in proportion of husk to Potato, Hamilton, and Scots Birlie. In 1903–4 the following were the average percentages of husk :—Sandy, 22·47; Potato, 23·91; Newmarket, 23·60; Goldfinder, 23·10; Waverley, 23·51; and Banner, 24·27. From six to ten samples of each of these were examined and the samples were drawn from a wide area, representing considerable differences in soil and climate, so that the results are representative of what may be expected on the average in practice in Scotland.

On the average the new varieties were found to contain more husk than the old. The old varieties thus on the average give a greater weight of kernel, and consequently of meal, for a given weight of grain.

Oil and Albuminoids.—The old varieties were much richer in oil than the new. On the average of four years, Potato gave the highest percentage, 9·22; Sandy contained 8·99 per cent.; Hamilton 8·81 per cent.; and Scots Birlie 8·45. Of the new varieties the following were the best :— Wide Awake, 7·43 per cent.; Banner, 6·99 per cent.; Waverley, 6·98 per cent. Mr. Hendrick concludes that (1) the grain of the well-known old Scotch varieties of oats is in general richer in oil than that of the new varieties; (2) Potato and Sandy oats are specially rich in oil, and may be expected to be distinctly richer than Banner, Waverley, Thousand Dollar, Siberian, Goldfinder, Newmarket, Tartar King, and Storm King; (3) of new varieties, New Zealand and Wide Awake are

* There were no Societies of this class at work in Scotland or Ireland.

† The summaries of agricultural experiments which have appeared in the present volume have been as follows :—Experiments with Cereals, April, p. 59. The Board would be glad to receive for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

comparatively rich in oil, and overlap the old varieties to some extent; (4) Newmarket, Tartar King, and Storm King are poor in oil. He considers that the high reputation of Scotch oatmeal may be to some extent due to the richness in oil of such largely grown varieties as Potato and Sandy.

The old varieties are also on the average the higher in albuminoids, but the difference in this case is not so great or so consistent. Potato contained 15·16 per cent. and Sandy 16·33 per cent. The new varieties ranged from 13·47 to 15·04 per cent., with the exception of Storm King, which, though thick-husked and poor in oil, contained 16·49 per cent. of albuminoids.

The effect of the weather on the composition of oats was also examined, and the percentage of oil appeared to be generally higher in dull cool seasons, and that of albuminoids higher in fine dry seasons, but on this point further evidence is required.

Composition of Straw.—As far as chemical composition alone is concerned, the straw of the new varieties appeared to be quite as good as that of the old, the percentage of albuminoids being slightly higher.

The following is the percentage composition of two varieties of grain in 1901–2, and straw in 1903–4:—

GRAIN.

	Potato.	Waverley.
No. of analyses	4	4
Water	12·23	12·32
Dry kernel	65·82	65·29
Dry husk	21·64	21·95
Dry kernel contained: oil	9·94	7·06
Dry kernel contained: albuminoids ...	14·05	14·79

STRAW.

	Potato.	Waverley.
No. of samples...	3	2
Albuminoids	3·64	3·62
Crude fibre	42·27	44·16
Ash	5·06	5·94
Containing siliceous matter	1·48	1·96
Soluble carbohydrates, &c. ...	49·03	46·27

Varieties of Oats (*Univ. Coll. of N. Wales, Bangor, Bull.* 5, 1909).—Twenty-one varieties of oats were grown at Madryn in 1909. The yields were remarkably good, and there was little to choose between a number of the best plots. The first five in yield were Schlandstedter (114 bus. of 42 lb.), Beseler's Prolific (109 bus.), Abundance (108 bus.), Banner (108 bus.), and Wide Awake (106 bus.). This experiment has been carried on for seven years and results are given in the report for each year. Over this period there has been little difference between such well-known varieties as Abundance, Newmarket, Wide Awake, Banner, Waverley, and Stable King. Daubeny and the German varieties—Beseler's Prolific, Schlandstedter, and Anderbecker, have not been grown so frequently, but are comparable to the others. The yellow and black varieties never cropped so well at Madryn as many of the white oats. They did better in the early years of the experiment, when the yields were altogether lower and when the land was presumably in poorer condition. Goldfinder proved a useful yellow variety, provided it was sown early enough to ensure ripening in good time.

Effect of Change of Seed on Oats (*Univ. Coll. of N. Wales, Bangor, Bull.* 2, 1909).—In 1905, 1907, 1908, and 1909, Abundance oats obtained from ten to thirteen different districts of the British Isles were sown on adjoining plots in the same field at Madryn, alongside a plot sown with home-grown seed. The yields varied each year, but the differences between the plots were small, and not greater than might be obtained on any similar number of plots of the same size sown with the same seed. Professor Winter concludes that no advantage is gained by changing seed oats in cases where home-grown seed, well dressed and of good quality, can be obtained.

The plots have usually been cut on the same day, and at the outside the plot last to ripen has never been more than a few days behind the earliest. The experiments have not, therefore, given support to the view often expressed that harvest may be hastened by obtaining seed from an earlier district.

EXPERIMENTS WITH ROOT CROPS.

Varieties of Mangolds (*Midland Agric. and Dairy Coll., Bull.* 3, 1909–10).—Eight varieties were compared in 1909 on seven farms. The season was unfavourable and the mangold crop in the Midlands was as a whole much below the average. The heaviest crop (31 tons 16 cwt. per acre) was given by Prizewinner Globe, and although its percentage of dry matter was almost the lowest, this variety, owing to its heavy crop, produced the greatest total yield of dry matter per acre, viz., 5546 lb. Windsor Globe was next with 29 tons 7 cwt. per acre, and 5436 lb. per acre of dry matter. The percentage of "bolted" roots was higher than in Prizewinner. Golden Tankard had the highest percentage of dry matter, but the smallest yield (20 tons 17 cwt.), and consequently the total dry matter produced was less than with any other variety, *viz.*, 4579 lb. In the five years over which the trials have extended, Prizewinner has each year given the largest average yield. The trials appear at present to show that the best quality mangolds—the Tankards—do not produce so much dry matter per acre as the roots giving a larger yield but with a lower percentage of dry matter. These experiments suggest, therefore, that the farmer's object should be to produce the largest possible quantity of roots per acre, consistent with fair quality.

Manuring of Mangolds (*Somerset C.C., Rept. on Field Trials of Manures,* 1904–8).—The object of this experiment was to determine whether artificials can be profitably used to supplement the usual dressing of dung. The experiment was conducted in all on thirty-five farms, with a variety of soils, mostly, however, inclined to be heavy. The land usually received from twenty to twenty-five loads of dung to the acre, the cultivation and seeding in each case following the usual practice of the particular farm. The plots were one-sixteenth of an acre, ten plots being laid out on each farm. The artificials applied were nitrate of soda, superphosphate, kainit, and salt, alone and in combination.

The average crop produced by the dung alone was 28 tons 8 cwt. per acre. The greatest increase on this, 7 tons 14 cwt., was produced by 2 cwt. nitrate of soda, 3 cwt. superphosphate, and 3 cwt. salt per acre (Plot 8), and the next, 7 tons 3 cwt., by the same mixture but with 3 cwt. kainit instead of the salt (Plot 7). Valuing the mangolds at 8*s*.

per ton, and deducting the cost of the artificial manures, the most profitable dressing, however, was 3 cwt. of salt alone (Plot 5). This produced an increase over the plot receiving dung alone of 4 tons 6 cwt., and, owing to its small cost, a profit due to the salt of 29*s.* 6*d.* per acre. The dressing of nitrate of soda, superphosphate, and salt (Plot 8) gave an estimated profit of 26*s.* 3*d.* per acre; 2 cwt. nitrate of soda and 3 cwt. salt (Plot 9) gave 24*s.* per acre, and the nitrate of soda, superphosphate, and kainit (Plot 7) gave 18*s.* per acre.

The experience gained from these experiments suggests that the application of artificial manures to mangolds in addition to a good dressing of dung is profitable, and in view of the better quality of the roots on Plots 7 and 8, together with the fact that a more even plant was obtained, the use of either of the mixtures applied to these plots is recommended. Artificials appear to assist in giving the crop a start, particularly in an unfavourable season, and as it is a matter of the greatest importance to secure a regular plant, the use of artificial dressings in some form or other can for this reason be recommended.

Manuring of Mangolds (*Univ. Coll. of N. Wales, Bangor, Bull.* 4, 1909).—This experiment was carried out at six centres in 1909. The season was not a normal one so far as mangolds were concerned, and practically no crop was produced on the unmanured plot at three of the centres. The average crop on the unmanured plots at all centres was 10 tons 9 cwt. Ten tons farmyard manure per acre increased this to 22 tons 17 cwt., and 20 tons farmyard manure gave 27 tons 10 cwt. If the manure is valued at 5*s.* per ton, the 4 tons 13 cwt. of mangolds produced by the additional 10 tons of farmyard manure cost 11*s.* per ton, at which rate the manure could have been more profitably used elsewhere. A dressing of 128 lb. nitrate of soda, 349 lb. superphosphate, and 82 lb. sulphate of potash, costing £1 8*s.* 9*d.*, when applied with 10 tons of farmyard manure, gave an increase in crop of 4 tons 6 cwt., but the same dressing, used in conjunction with 20 tons of farmyard manure, gave an increase of only 1 ton 7 cwt. above the manure alone.

Manuring of Mangolds (*Hereford C.C., Rept. on Field Trials on the Manuring of Mangolds in* 1909).—Trials were conducted at seven centres. A dressing of farmyard manure was given to all the plots, with the exception of one centre, where only the artificials were used. On the plots to which no artificials were applied the average crop was 26 tons 17 cwt. The most profitable dressing was 1 cwt. sulphate of ammonia, 1 cwt. nitrate of soda, 4 cwt. superphosphate, ¾ cwt. sulphate of potash, and 3 cwt. salt. This cost £2 7*s.* 6*d.* per acre, and resulted in an average increase in the crop of 11 tons 14 cwt., which, valued at 10*s.* per ton, would give a profit due to the manures of £3 9*s.* 6*d.* Three cwt. of salt added to the general dressing of artificials gave a good profit, and when salt was used sulphate of potash gave better results than muriate of potash. Four cwt. superphosphate per acre was compared with an equal money value of steamed bone, dissolved bone, and basic slag, and always proved superior.

Manuring of Mangolds (*Rothamsted Expt. Station, Ann. Rept. for* 1909).—The results are given of the mangold crop on Barn field with different systems of manuring.

Manuring of Turnips (*Aberdeen and N. of Scotland Coll. of Agric., Leaflet* 7).—These experiments were carried out at fourteen centres in

1908. By omitting in turn nitrogen, phosphoric acid, and potash from a complete dressing, phosphoric acid was shown, as in the previous five years, to be the constituent most required by the soil.

Calcium cyanamide and nitrate of lime were compared with sulphate of ammonia, quantities of each containing the same amount of nitrogen being applied. Both the new manures yielded slightly smaller results than sulphate of ammonia, but the differences were so small as to be within the range of experimental error in most cases, and therefore the manures appear to be equally useful in the production of turnips, and which of them should be used can be decided by the price per unit of nitrogen.

In a trial of the most profitable quantity of superphosphate, the results of 1907 were confirmed. Both with and without dung 6 cwt. of superphosphate gave a larger crop than 3 cwt., but the value of the increase did not cover the greater cost of the manuring; 9 cwt. produced a diminution in the crop. The larger quantities might be profitable at the end of the rotation, on account of their residual values, but apart from this, 3 or 4 cwt. of superphosphate appears to be the limit of profitable application so far as the turnip crop is concerned.

High and low grade basic slag were compared on two plots. The same quantity of phosphoric acid was applied per acre, and the results were almost identical. 5¾ cwt. per acre of the high grade slag was used, at a cost of 33*s*. 7*d*., and as the quantity of low grade slag (11½ cwt.) necessary to supply the same amount of phosphoric acid cost 40*s*. 9*d*., the profit due to the use of the high grade slag was 4*s*. greater.

The practice of applying a few cwt. of superphosphate, as the only artificial fertiliser along with dung, is not uncommon. A comparison of the plots, however, showed how much more profitable is a complete or balanced manure when no dung is used, and when dung is applied it is still necessary to supplement the superphosphate with nitrogen and potash if a full crop is to be obtained.

Manuring of Swedes (*Midland Agric. and Dairy Coll., Bull.* 4, 1909–10).—These trials have now been carried out for six years and will be continued in 1910. In 1909 ten loads of farmyard manure per acre gave an increase over the unmanured plot of 4 tons 16¾ cwt. per acre, and fifteen loads farmyard manure an increase of 6 tons 1 cwt. Ten loads supplemented by the following dressing of artificials:—Sulphate of ammonia, 75 lb.; superphosphate, 250 lb.; sulphate of potash, 30 lb., produced an increase in yield over the unmanured plot of 7 tons 8½ cwt., at a cost for the artificials of 16*s*. 6*d*. per acre. The most profitable form of manuring was by artificials alone. Double the quantities already mentioned were applied, at a cost of 33*s*. per acre. The increase in the crop amounted to 8 tons 19¼ cwt., which, valued at 10*s*. per ton, gives a profit of 56*s*. 7*d*. per acre. In the last six years the profit from this dressing has been on the average 40*s*. 6*d*. per acre.

Sulphate of ammonia has been compared with nitrate of soda in a complete dressing, and the former has proved more profitable, the average difference in profit in six years being 3*s*. 3*d*. Superphosphate has given a considerably larger annual profit than basic slag, dissolved bones, or bone meal. As a source of potash sulphate of potash has given better results than either muriate of potash or kainit.

Manuring of Swedes (*Cumberland and Westmorland Farm School,*

Newton Rigg, Thirteenth Ann. Rept., 1908–9).—The following results were obtained in 1908, which confirm those of former years :—

Plot.		Tons.	Cwts.
1	No manure	7	17
2	$3\frac{1}{2}$ cwt. kainit and $7\frac{1}{2}$ cwt. superphosphates	29	0
3	1 cwt. nitrate, 2 cwt. kainit, 6 cwt. slag	28	11
4	1 cwt. nitrate, 2 cwt. kainit, 5 cwt. superphosphates	28	7
5	12 tons dung	25	2
6	12 tons dung and one-quarter of Plot 4 dressing ...	28	12

The cost of the artificials used on Plots 2, 3, and 4, was 29*s.* Evidently as good crops of swedes may be grown with artificials as with farmyard manure, and at a comparatively small outlay. The deciding consideration in good farming as to the extent to which artificials should replace farmyard manure, will be the extent to which the swedes will be consumed by sheep on the land where grown. If all are to be thus disposed of, as is frequently the case on light land, the crop may be grown entirely with artificials; if half the crop only is to be eaten on the ground, then half the dung of Plot 5 and half the artificials of Plot 3 or 4 would be good management; and if all the roots are to be carted off, then the full dressing of dung assisted by a small artificial dressing as with Plot 6, should be applied, so as to leave the land in good condition for the corn and seed-grass crops which are to follow.

FOREIGN EXPERIMENTS.

Experiments with Lime-Sulphur Wash in the United States (*U.S. Dept. of Agric., Bureau of Plant Industry, Circular No.* 54).—In recent years Bordeaux mixture has become to some extent unpopular among apple growers in the United States on account of its injurious effect upon the fruit and foliage of certain varieties, and in this publication Mr. W. M. Scott, Pathologist in charge of orchard-spraying experiments, deals with the work which has been done to test the effectiveness of lime-sulphur wash as a substitute for Bordeaux mixture. Reference to this subject, with directions for making the mixtures, was made in this *Journal* for August, 1909 (p. 408). Briefly, it may be stated that there are three types of wash in use, *viz.*, (1) the home-boiled lime-sulphur wash, (2) ready-made concentrated solutions sold by the trade, and (3) the self-boiled lime-sulphur mixture, which is a combination of lime and sulphur boiled only with the heat of slaking lime. The experiments were largely intended to ascertain the strength at which these solutions can be safely and effectively used, but it is pointed out that the results may vary, not only with the locality, but also with the variety of apple grown.

The experiments were carried out in Virginia, Arkansas, and Michigan, on a number of orchards, and the following is a summary of the general conclusions drawn from them.

A lime-sulphur solution containing, when diluted, about 4 lb. of sulphur to 50 gallons of water, appears at present to be the most promising preparation. This may be obtained by using the commercial solution at the rate of $1\frac{1}{2}$ gallons to 50 gallons of water, or by preparing the lime-sulphur solution at home and diluting it so that each 50 gallons will contain 4 lb. of sulphur. The mixture at this strength injured apple foliage in Virginia very little, and if these results could be taken as a reliable guide, there need be no hesitancy in using it; but,

under different conditions, the results might be different, and the matter must still be considered as more or less experimental. A strength of $1\frac{1}{4}$ gallons of the commercial solution may prove to be sufficient in most cases, and the danger of injury would then, perhaps, be entirely eliminated.

The experiments made by the Department of Agriculture, in 1908 and 1909, as well as the published records of other investigators, show that the lime-sulphur solution is apparently as effective as Bordeaux mixture in the control of apple scab. Under more severe conditions than those which existed in the experimental orchards, the treatment might fail; but at present it is very promising. Lime-sulphur will control leaf-spot and other minor troubles, as well as apple scab, but so far it has not proved to be a satisfactory remedy for apple blotch (*Phyllosticta*) or bitter-rot. However, the experiments on those two diseases have not been carried far enough to determine what may be expected of it in this connection.

The self-boiled lime-sulphur is entirely harmless to apple foliage, and apparently has a stimulating effect, but it is not as effective against scab as the boiled wash. The experiments show that it will control mild cases of scab and will entirely prevent leaf-spot, "fruit-spot," and the sooty fungus, but in districts where scab is a serious disease this wash would probably be inefficient.

According to the information at hand, arsenate of lead is unquestionably the poison to use with the lime-sulphur mixture. Instead of increasing the caustic properties of the mixture, as at first feared, it apparently has the opposite effect to some extent, and does not lose any of its insecticidal value by reason of the combination. In all the experiments the combination of Paris green and the lime-sulphur solution proved to be injurious to apple foliage, and in Arkansas the combination of arsenite of lime and lime-sulphur was exceedingly injurious.

According to the results obtained in the Arkansas experiment, three applications of the commercial solution at a strength of 1 gallon to 30 gallons may be made without material injury to apple foliage, but after the fourth application the injurious effect becomes serious, and after the fifth the injury is almost disastrous to both fruit and foliage. It appears, therefore, that the injury is cumulative, and that it is unsafe to make more than three applications, or four if one is made before the trees bloom.

OFFICIAL CIRCULARS AND NOTICES.

Exportation of Horses to Belgium or the Netherlands.

The Board of Agriculture and Fisheries have made an Order to enable Local Authorities to enforce more effectively the provisions of the Exportation of Horses Order of 1898, and to ensure that decrepit horses intended to be shipped from Great Britain shall in every case be examined and passed as fit for the voyage by a veterinary inspector of the Local Authority of the port of shipment. To secure examination in every case in which it is desirable, the Order requires that notice of the intended exportation of any horse, whether decrepit or not, from Great Britain to Belgium or the Netherlands, shall be given to the Clerk of the Local Authority

of the port of shipment, or to some person appointed by the Local Authority to receive such notices, in time for its receipt, not less than twenty-four hours before the time of intended shipment.

The notice must contain certain specified particulars intended to enable the Local Authority to judge in each case whether a veterinary examination is desirable. Veterinary examination is not required in any case in which the Local Authority are satisfied that the class of horse makes examination unnecessary, but no horse may be shipped from Great Britain to Belgium or the Netherlands without a permit of the Local Authority of the port of shipment.

The Order will come into operation on June 1st next, and copies of it may be obtained on application to the Secretary, Board of Agriculture and Fisheries, 4 Whitehall Place, London, S.W.

Departmental Committee on Swine-Fever.

The President of the Board of Agriculture and Fisheries has appointed a Departmental Committee to inquire into the cause of the continued prevalence of swine fever in Great Britain, and to report whether it is practicable to adopt any further measures with a view to secure its speedy extirpation.

The Committee will be constituted as follows:—Mr. George L. Courthope, M.P. (Chairman); Sir Luke White, M.P.; Mr. A. W. Anstruther, C.B., one of the Assistant Secretaries of the Board of Agriculture and Fisheries; Colonel M. Locke Blake, V.D.; Mr. Charles M. Douglas, M.A., D.Sc.; Mr. Frank W. Garnett, M.R.C.V.S.; Colonel Charles E. Longmore, V.D.; Professor L. Penberthy, F.R.C.V.S.; Mr. Stewart Stockman, M.R.C.V.S., Chief Veterinary Officer of the Board of Agriculture and Fisheries.

Mr. P. S. Lawrie, of the Board of Agriculture and Fisheries, will act as Secretary.

The following memorandum was issued in April in order to distribute information as to the Large Larch Sawfly:—

Memorandum on the Large Larch Sawfly. (Nematus erichsoni. Hart.)

In recent years the larch plantations of Great Britain have been visited by a pest which has already caused great losses in certain places and threatens to inflict serious injury on British Forestry. The Large Larch Sawfly is known to have done much damage in Denmark about sixty years ago, and in more recent times has devastated the larch forests of North America. How long it has been present in Great Britain is not known, but its presence was not officially confirmed till 1906, when it was reported from Cumberland. It has since been found over a large area in Wales, a wide district in the north of England, and a very considerable area of the south of Scotland. It probably exists in other parts of the Kingdom. There is reason to believe that up to the present the general attack is but slight, but in the spots where the prevalence of the pest is greatest many thousands of trees have been killed. Nor is it likely that the plague will go no further. There are evident signs that it has spread in recent years, and it is recorded that in the United States and in Canada it did not stop till 50 to 100 per cent. of the matured larch over vast areas was destroyed, with the loss of many billions of feet of timber. The serious nature of this prospect

has led the Board to place the Sawfly among the dangerous insects scheduled under the Destructive Insects and Pests Order, the presence of which on any plantation must at once be reported to the Board. They are also engaged on an investigation of the extent to which it prevails in this country in the hope of discovering some preventive or remedial measures. Every occupier of any premises on which the insect is found, is bound therefore to report the discovery under a penalty of ten pounds, but few cases have been reported chiefly on account of the inability of most persons engaged in forestry to identify the pest, or recognise the symptoms of an attack. The Sawfly remains in its larval state for only a few weeks of the year, and for some part of that time it is very small and, consequently, easily overlooked. The appearance of an attacked tree, however, is such that for a much longer period the characteristics can be distinguished by an expert. In spite, however, of this extension of time it is not possible for the Board's Inspectors to examine every larch plantation in Great Britain, and the Board feel it incumbent on them to ask for the assistance of every person interested in forestry in tracing the presence of the infestation.

The search may be conducted in two ways :—

1. The actual insect may be looked for as (1) egg embedded in the shoots of the tree, (2) caterpillar feeding on the green needles, (3) cocoons lying in the ground or among the long grass, (4) adult on the wing.

2. The larch trees may be examined for signs of Sawfly attack, even though no insect can be found.

The caterpillars or larvae of the Large Larch Sawfly may be first looked for towards the middle and end of June. In 1909 the first seen were not discovered till July 4th, but they were evidently some days old and the season was rather late. They appear in considerable numbers on the lower branches of the larch, generally towards the terminal shoots in which the eggs are laid. As they grow older they advance towards the stem, and eventually may be found wherever there are any needles. Larvae begin to spin up their cocoons in July. In 1909 the last caterpillar was seen on August 31st, but in other years they might be found later.

When very small they are not easily noticed, but they grow rapidly, and when full grown are about three-quarters of an inch long, with round *black* heads, three pairs of *black* thoracic legs, and seven pairs of abdominal legs of a greyish green, the same colour as the rest of the body.

The caterpillars feed at first in clusters, but afterwards they separate in search of food. They assume various characteristic positions, a common one being with their "tail end" curled round the shoot on which they are feeding. When disturbed they erect the hind segments of the body over the front ones. The larvae of the Large Larch Sawfly can be distinguished from other larvae that may be found on the larch by the following characters :—

Moth caterpillars.	*Nematus erichsoni.*
Legs never more than sixteen. If they are geometer caterpillars they progress by a looping	The caterpillars have twenty legs.

or spanning movement characteristic of this family.	The mode of progression is continuous.

Other Sawflies:—

The *Nematus laricis*, or Small Larch Sawfly caterpillar has a brown head, is grass green or greenish brown in colour. It is full grown in July.	Has a black head, and body is greyish green. Feeds and grows till the end of August.

The larvae leave the trees when full fed and spin cocoons in which they live till the spring when they pupate. The cocoons may be looked for under the affected tree not only near the trunk but also over the whole surface covered by the crown of the tree. The cocoons are found in the soil under the moss and litter that usually cover the ground under larch trees and this must be turned back when the cocoons are being hunted for. These are dark brown and cylindrical with rounded ends, and about half an inch long.

The adult Sawfly on emerging from the cocoon, after the pupal stage is over, is in general appearance black, with glassy wings. The female flies at once to the lower branches of the tree, to lay her eggs, but apparently much of the life of the insect in this stage is spent on the wing and round the upper branches. It can therefore easily be overlooked and is difficult to identify at any distance. The Large Larch Sawfly is nearly twice as long as the Small Larch Sawfly and can be distinguished from the latter which is quite black by the red segments of the abdomen.

Larch plantations that are suspected of having been attacked should also be examined with the object of discovering traces of infestation. This work may be carried out from the middle of June to the end of November. The symptoms to be looked for are as follows : In June and July a search should be made on the terminal shoots of the branches for signs of eggs, which are laid alternately in two rows. The number is usually about twenty, but as many as forty have been found. The easiest sign, however, to notice, is the distortion of the current year's shoots, which often curl up when eggs have been laid in them. A closer examination will generally reveal the incisions made by the Sawfly's ovipositor on the concave side of the curled shoot. The slits where the eggs have been laid resemble small eyes less than one-tenth inch in diameter. A little later, in July and August, the needles should be examined for signs of feeding. The young caterpillars do not eat the whole needle but bite pieces out of the edges of it. At a later date when the caterpillars are more fully grown, and separate in search of food the whole rosette of needles will be eaten or only a stump left. In August and September these defoliated dwarf shoots may sprout again, and present almost the same appearance as they did in May, except of course that the growth is irregular. These indications are to be found in varying intensity on all trees that have been attacked, but in the case of a serious infestation the trees present a brown and withered appearance which is noticeable hundreds of yards away, and after a little practice the more seriously affected trees can be picked out at a distance. When the attack is very serious and prolonged the trees die and there is then no difficulty in realising the damage done.

Nearly all these manifestations are shown in the articles on the Sawfly which were written for the *Journal of the Board of Agriculture* by Dr. MacDougall and Dr. Hewitt, and in Leaflet 186.

The Board would be glad if all persons connected with the care of larch plantations would search for the pest during the summer and autumn of 1910, and would communicate to them immediately the discovery by the presence of any of the above mentioned indications of Sawfly attack. In order, however, to make any report of value the following additional information should be sent:—

1. The name of the wood or plantation with some indication of the place where it is to be found.

2. The approximate size of the wood.

3. A description of the intensity of the attack according to the following scale:—

Intensity I.—(Worst). Some trees already dead; others with crowns very thin and practically defoliated in mid-summer. General appearance of trees moribund. Leading shoots have been attacked.

Intensity II.—No trees dead. Trees badly browned in mid-summer. Few terminal shoots to lateral branches produced during current year, dwarfed shoots thereby stimulated to growth with result that these new shoots have been utilised for egg laying by the Sawfly.

Intensity III.—No trees dead. Considerable numbers of the terminal shoots of lateral branches have had eggs laid in them. Little or no browning effect in mid-summer.

Intensity IV.—No trees dead. Very few lateral shoots show signs of attack.

The Board are endeavouring to organise an experiment in controlling the Sawfly and will be glad to hear from owners of attacked plantations who are willing to assist.

IMPORTATION REGULATIONS.

Importation of Dogs into Jamaica.—Law No. 19 of 1909 includes dogs among animals that are subject to examination and quarantine for fourteen days on landing in Jamaica. The regulations were summarised in this *Journal*, April, 1907, p. 33.

Importation of Potatoes into Rhodesia.—In accordance with Regulation No. 309 of 1909, potatoes imported into Southern Rhodesia from outside South Africa must be accompanied by a certificate from the consignor stating fully in what country and district they were grown, and that wart disease or black scab (*Chrysophlyctis endobiotica*, Schilb.) is not known to occur on the land on which the potatoes were grown. Any consignment found on arrival to be infected with wart disease will be destroyed; if it is infected with any other disease the diseased tubers will be destroyed, and a charge of 6*d.* per bag made for sorting.

MISCELLANEOUS NOTES.

Agricultural Exhibitions.

Fruit Show and Congress at Hexham.—A fruit congress and fruit show will be held at Hexham on October 20th–22nd next, with the object of encouraging fruit culture in the four northern counties. Lectures on fruit cultivation, insect pests and their prevention, and other subjects relating to the cultivation of fruit, will be delivered by various authorities. At the fruit exhibition

only fruit grown in the four northern counties will be allowed to compete.

Agricultural Exhibition in Chile.—The Board are informed that an International Exhibition of Agriculture and Agricultural Machinery will be held at Santiago, Chile, in November next.

Agricultural Show at Lagos.—The *Southern Nigeria Government Gazette* of February 23rd announces that the Lagos Agricultural Show will be held on December 8th, 9th, and 10th next. It is hoped that a leading feature of the show will be the section for implements and machinery suitable for the cultivation of tropical produce and for its preparation for export and for local consumption.

Copies of the preliminary announcement regarding the show may be obtained by British firms on application to the Commercial Intelligence Branch of the Board of Trade, 73 Basinghall Street, London, E.C.—(*Board of Trade Journal,* April 7, 1910.)

Notes on Agriculture Abroad.

Decrease in the Agricultural Exports from the United States.—Mr. Consul-General Bennett, in his Report to the Foreign Office on the Trade of New York (*Annual Series, No.* 4408), refers to the shrinkage of the wheat supplies sent from the United States to the United Kingdom, and remarks that the production of wheat in the United States might indeed be very largely increased by more scientific farming, it might perhaps even be doubled, but it is doubtful whether such an increase in land under wheat would pay the farmer who has other more profitable crops within reach. At the present time the home demand can be met in all directions, but the margin is not nearly so large as it was, and the day is not far distant when the United States will not export a grain of wheat, when the whole will be required for home consumption and when, even, it may be necessary to import wheat for the use of the people.

The United States therefore cannot be relied upon in future as in the past to satisfy the British demand for bread.

As regards the supply of other food products, such as beef, fresh and chilled, beef products and dairy products, and the amount available for exportation, exact details are more difficult to procure.

It has been stated, however, again and again, that the demand is gaining on the supply, and that as the local demand is increasing year by year with the increase of population, the quantity available for export must diminish in the same manner as the wheat supply has been affected.

Danish Co-operative Societies.—According to the *Smor-Tidende* of April 15th, 1910, the number of co-operative dairies in Denmark in the year 1909 was 1116, and the number of co-operative bacon factories 35. There were at the same time 1310 cattle-breeding societies, with 1550 bulls; 260 horse-breeding societies, with 310 stallions; and 250 pig-rearing societies, with 326 boars. All of these breeding societies receive subventions from the State, which is also the case with the milk-testing associations, the number of which is 508.

Horse and Cattle Rearing in Japan.—The Canadian Trade Commissioner at Yokohama (Mr. G. A. Harris) states, in a recent report to his Government, that the Japanese Government directly encourage

horse breeding by maintaining two stud farms at Hiroshima and Ishikari. For stocking these farms they import thoroughbreds for breeding purposes, and distribute their colts throughout the country. Some of the Prefectural Governments also have farms on a smaller scale for the same purpose. In addition there are extensive farms owned by private individuals where the improvement of the breeding not only of horses, but also of other live stock, is carried on. The largest of these is the Koiwoi farm, situated near Morioka, and owned by Baron Iwasaki.

Before the Russian war, Japan consumed very little meat. During the campaign, however, the soldiers were supplied with meat, and since then its use has become more general among the Japanese. As pasturage in Japan is limited, most of the hills being covered with bamboo grass, cattle raising is confined to certain localities. Most of the cattle in Japan are in the Settsu district, but as the northern part of the mainland and Hokkaido have good pasturage, several large farms have been started there with success. The Government recognise that it pays to have the best stock, and are importing thoroughbred bulls and cows from different parts of the world. The calves are distributed throughout the country. About 42 per cent. of the total imports are used for breeding purposes, the remainder being consumed as food.

Experimental Farms in Northern Italy.—The Foreign Office Report on the Trade of Venice for 1908–9 (*No.* 4406, *Annual Series*) gives some information as to the experimental farms in the provinces of Venetia. Every school of agriculture in these provinces, it is stated, has wisely adopted the plan of having a large experimental farm for practical agricultural instruction in their respective districts. There is one at Gambarare in the province of Venice consisting of 50 fields, equivalent to about 47 acres; 37 fields were given to farmers for cultivation on condition of their yielding half the produce to the school, and 13 fields were allowed to be kept by the old tenants on the same rent they were paying to the former owners. The *metayers* have to follow the directions of the school with respect to the cultivation of maize, wheat, grass, beet, potatoes, &c. There are also vines and some mulberry trees. The capital required for purchasing the necessary cattle was collected among the local agriculturists by shares of 100 lire (£4), to be gradually reimbursed from the income of the land, so that the school will eventually remain sole owner of the cattle. At the end of the past two years the *metayers* were in a prosperous condition and the school, after having paid the rent of the farm and having put aside a reserve fund, paid off about 20 shares. The farm is supplied with an equipment of agricultural machines. Agriculturists have free access to the farm and the right to inspect the books relative to its administration.

The *Scuola Paterna* also maintains a small model farm at the Lido chiefly for the cultivation of horticultural produce and fruit. There is an experimental farm at Brusegana in the province of Padua, one at Quinto di Valpantena in the province of Verona, one at Conegliano in the province of Treviso, one at Sant Osvaldo and one at Pozzuolo in the province of Udine. The Count of Asarta has a large model estate at Fraforeano, in the last named province, which is provided with

electric power for driving machinery for farming operations and other purposes. Such experimental farms will no doubt be of great advantage for improving agricultural education in the rural districts, as all possible facilities are afforded to agriculturists for visiting the farms and obtaining practical information on all agricultural matters.

Demand for Agricultural Machinery.

Agricultural Machinery in the Caucasus.—The principal articles which find a ready sale in the Northern Caucasus are all kinds of machinery, especially milling and agricultural machinery, and iron goods. Grass mowers, horse rakes, reapers and self binders are imported from the United States of America. German threshers also are sold in the Northern Caucasus; these all come overland, the head depôt for such machines being at Rostov-on-Don.—(*Board of Trade Journal*, April 26, 1910.)

Agency for Poultry-Rearing Appliances.—H.M. Consul-General at Marseilles (Mr. M. Gurney, M.V.O.) reports that a firm in that city are desirous of obtaining agencies for British poultry-rearing appliances. The firm are setting up a model poultry and poultry-rearing establishment, which they propose to make a kind of permanent poultry exhibition, and where an incubator room will be open to the public.

Communications from British makers interested should be addressed to the British Consulate-General, Marseilles.—(*Board of Trade Journal*, April 14, 1910.)

Agricultural Machinery in Bulgaria.—H.M. Minister at Sofia has informed the Board of Trade that competitive trials will be held, between July 18th and 23rd next, at the Government stud farm near Plevna, of steam threshers of 12 h.p. and over. The trials are to be held under the auspices of the Ministry of Commerce and Agriculture (Veterinary and Zootechnical Department), and machines of the type of that most successful in the trials will be purchased by the Department, who will also recommend them to other Government institutions and to private landowners. All cost of transport and installation must be borne by the competing firms. The threshers must be fitted with chaff cutters and with elevators for hoisting sheaves and stacking straw, and must burn straw, wood or coal. The prices of the machines must be stated before the trials begin.

H.M. Minister at Sofia reports the announcement in the local press that an experimental station for the trial of agricultural machinery of all kinds has been started at the model farm ("Obrastzov Chiftlik,") near Rustchuk. The results of the trials will be communicated to all persons interested, and advice will be given to cultivators in order to assist them in obtaining improved types of machinery.

In connection with the experimental station a museum is to be opened, where agricultural machinery, models, plans, &c., are to be on view. Firms are invited to send exhibits, plans, &c., of machinery to the museum. Should any British firm wish to supply plans and specifications of their manufactures, these should be drawn up in French or German; metric weights and measures should be used, and prices stated in francs. It would be useless, adds H.M. Minister, for British firms to try to do business in Bulgaria unless they were prepared to give

a certain amount of credit.—(*Board of Trade Journal*, April 7 and 21, 1910.)

Agricultural Machinery in Northern Italy.—The Foreign Office Report on the Trade of Venice in 1908–9 (4406 *Annual Series*) states that the adoption of agricultural machines was slow until some years ago, but since the commencement of the agrarian movement most of the landed proprietors have deemed it indispensable to provide themselves with an equipment of such machines. There is an enormous advance in the making of agricultural engines in Italy, and large orders are said to be always in hand at the manufactories. Notwithstanding all this, the import into the kingdom of foreign machines, which about twelve years ago was only £100,000, rose in 1908 to over £640,000.

Notes on the Weather in April.

In the *first* week of April the weather became less dry than at the end of March, and varied a good deal. In most parts of Britain the sky was generally cloudy, and some days were more or less rainy. Rainfall exceeded the normal over the eastern half of England, but was less elsewhere. Warmth was "deficient" in England S.E. and S.W., and Midland Counties, elsewhere it was "moderate." Sunshine was "scanty" over the whole of England ("very scanty" in the Midland Counties), and "moderate" in Scotland.

The *second* week was very unsettled over the whole country. Rain fell at nearly every station after Monday, and thunderstorms were experienced in many localities. The temperature rose in England, and warmth was "unusual" in the N.E., E., and Midland Counties; "moderate" in N.W., S.W., and S.E. In Scotland it was "deficient." Sunshine varied, but was generally much below the normal, except in England E.

During the *third* week the weather was still cloudy and unsettled. Warmth was generally "moderate," but was "unusual" in England N.E. and S.E., and "deficient" in Scotland E. Passing showers of rain were very common, the fall on the whole being moderate, except in Scotland W., where it was heavy. Sunshine was "very scanty" in England S.W. and S.E., and "scanty" in all other districts except Scotland E. (moderate).

In the *fourth* week the weather was very changeable, with frequent showers of rain or hail, and occasional snow over the northern and eastern districts. The showers were, however, interspersed in most places with considerable periods of fine, bright weather. Warmth was "deficient" in all districts, except England E. Rainfall in most districts did not diverge very much from the normal. Sunshine was "abundant" everywhere except in England N.E. and N.W., where it was "moderate."

During the first quarter of 1910 in the United Kingdom rain fell on 54 days, while in the average of the 25 years, 1881–1905, it fell on 51 days; the total fall was 8·0 in., compared with a 25-year average of 7·7. Temperature was almost identical with the average, viz., 40·0 deg., against 40·1 deg. In the same time the duration of bright sunshine was 108 per cent. of the 25-year average. Thus in all respects the first quarter of the year differed but little from the average.

Notes on Crop Prospects Abroad.

The following information has been published by the International Institute of Agriculture, Rome, in the *Bulletin of Agricultural Statistics* for April (No. 4) :—

The condition of the crops is given in tabular form as follows :—

CONDITION OF CROPS (100=average.)

Country.	Winter Wheat.		Winter Rye.		Winter Barley.	
	April 1st, 1910.	Mar. 1st, 1910.	April 1st, 1910.	Mar. 1st, 1910.	April 1st, 1910.	Mar. 1st, 1910.
Bulgaria ...	118	120	116	115	117	117
Canada ...	92	92	—	—	—	—
Denmark ...	97	96	97	97	95	95
Holland ...	110 [1]	—	105 [1]	—	110 [1]	—
Hungary ...	110	110	108	108	110	110
Croatia and Slavonia	100	—	98	—	102	—
Japan	98	98	—	—	—	88
Luxemburg ...	90	92	95	101	94	100
Roumania ...	105	105	105	105	103	100
Sweden ...	100	100	100	100	—	—
Switzerland ...	95	95	92	95	103	101
Tunis	100	100	—	—	99	100
United States...	92·9	—	103·1	—	—	—

[1] Condition of the crops on April 12.

The following notes are given on the condition of the crops up to April 21st :—

Bulgaria.—In a few districts damage has been caused by field mice and rotting.

Canada.—The condition of wheat is the same as for last month. In Ontario wheat is in excellent condition. Insignificant damage to wheat in Alberta. Good rains in March.

Denmark.—Night frosts, especially in Jutland, have delayed development of the crops.

France.—The area of winter barley sown in 1909 was 367,440 acres, and of winter oats 1,988,970 acres, the latter being 110·4 per cent. of the area harvested in 1908.

Germany.—Weather conditions have been extremely favourable during the winter months for the crops which had already commenced to develop last autumn, and also for crops sown at the end of October and in November. The condition of wheat is in most cases very satisfactory and in several districts even very good. Rye has, in some cases, suffered by insufficient, or an excess of snow.

The work preparatory to spring sowing was so advanced on account of favourable weather that seeding was commenced as early as the beginning of March. With the exception of root crops, the entire work of sowing was completed in several districts before Easter (March 27th). The cold nights towards the end of March did not unfavourably influence the crops.

Hungary.—Generally speaking, the condition of the crops is satisfactory practically throughout the Kingdom. Here and there insects

have caused some damage, the exact extent of which cannot yet be ascertained, though in any case the damage is not important. The condition of the spring crops is, in general, good; late sown barley and oats also show good prospects. However, the cold weather has somewhat delayed work in the fields.

India.—The area of winter wheat sown in British India in 1909 was 27,699,800 acres, which is 107 per cent. of the area sown in 1908.

Luxemburg.—The cold weather at the end of March has considerably damaged the crops and delayed their development.

Roumania.—The growth of the crops is excellent.

Sweden.—On account of an early spring followed by hard night frosts, wheat and rye, which were well developed have, in some districts, begun to depreciate; this refers especially to the northern and western parts of the country.

Switzerland.—Generally speaking, the crops have wintered well, though wheat and rye have suffered slightly. Sowing of spring crops was commenced for wheat, rye and barley in April.

United States.—Winter crops sown in 1909 are as follows:—Wheat, 33,469,900 acres, 107·9 per cent. of the area sown in 1908; rye, 2,154,200 acres, or 101·2 per cent. of the area sown in 1908.

Argentina.—According to an article in the *Review of the River Plate* of March 11th, 1910, the Agricultural Department's estimate of the crop on February 1st is as follows:—Wheat, 3,825,000 tons; linseed, 800,500 tons; oats, 591,000 tons.

The British Consul at Buenos Aires (Mr. A. C. Ross), writing on March 16th, says that it is stated that the yield of wheat, linseed, and oats in the Province of Buenos Aires will give such poor results that the product of these will barely cover the expenses of the crop. In many cases the maize has been destroyed by locusts and drought. The cattle also have suffered very much from the same causes.

As the thrashing proceeds, it can be seen that not only is the quanttiy of the grain small, but the quality is very poor.

It is now estimated that the wheat available for export will barely reach 2,200,000 tons, the linseed also will be of medium quality only, and the balance for export will probably not exceed 600,000 tons.

The facts above mentioned refer chiefly to the Province of Buenos Aires, but in a lesser degree also to the Province of Santa Fé and Cordoba, where a great deal of wheat and maize is grown. The losses on stock mainly occurred in the Province of Buenos Aires.

The British Consul at Rosario, writing on March 23rd, states with regard to the wheat and linseed crops, that since the threshing of the grain is terminated, the result is found to be even worse than was anticipated. According to the latest reliable information, the shortage of the wheat crop in this consular district, as compared with last year, is now calculated at 30 per cent., and of linseed 40 per cent., while much of the grain is light and of poor quality. As regards the maize crop now being harvested, the yield promises to exceed by about 30 per cent. that of last year, when about 1,000,000 tons were exported from Rosario and adjacent ports.

Russia.—A report, dated April 15th, issued by the Central Statistical Committee and forwarded by the British Consul-General at Odessa, states that the summer and autumn of 1909 were dry, and rain, though

plentiful, came very late and was immediately followed by cold and wind. The winter, however, was moderate, and in many parts there was good rain and moist snow in the early spring. At the date of the report the general condition of the winter crops in South Russia was reported to be satisfactory, except in parts of the Provinces of Poltava, Ekaterinoslav, and Volhynia. In parts the crops were very satisfactory. With regard to spring crops the report states that the spring was very early, and field work began a fortnight earlier than usual, and progresses well. The area under spring-sown grain will be greater than usual, because parts of the ground destined for winter wheat could not be sown on account of the drought.

Fruit Crops in Holland.—Mr. Henry Turing, British Consul at Rotterdam, reported on May 2nd that the prospects for the coming fruit crop were very encouraging, the comparatively warm weather prevalent through the early months of the year having greatly helped to bring on the young buds, while the present state of strawberries holds out good promise.

United States.—The Crop Reporting Board of the Bureau of Statistics of the Department of Agriculture states that the area under winter wheat in cultivation on May 1st was about 29,044,000 acres, showing that 13·3 per cent of the area sown last autumn had been abandoned or given to other crops. The average condition on May 1st is given as 82·1, against 83·5 on May 1st, 1909, and 86·7, the mean of the averages of the past ten years.

Agricultural Labour in England during April.

The Board of Agriculture and Fisheries have been furnished by the Board of Trade with the following report, based on returns from correspondents in various districts, on the demand for agricultural labour in April.

Agricultural employment was generally regular, though a few day labourers lost time occasionally through rain. There was a moderate demand for day labourers in the Northern and Midland Counties, with a supply tending to be somewhat in excess of requirements; in the other groups of counties the supply of and demand for labourers were generally about equal. There was usually a sufficient supply of men for permanent situations, but some scarcity was reported from certain districts.

Northern Counties.—Employment was generally regular in these counties, except in the case of a few day labourers, who lost a little time through rain. Potato planting, cleaning meadows, hedging, &c., caused a moderate demand for these men, but the supply was invariably sufficient, and a surplus was reported in several districts in *Cumberland* and the West Riding of *Yorkshire.*

Midland Counties.—There was occasional interruption from showery weather to the employment of day labourers in some districts, but employment on the whole was regular. The demand for men of this class was not generally so good as a month ago, and correspondents in several counties mentioned a surplus in the supply. A demand for men for permanent situations was reported in certain districts, but the supply of this class of men was generally sufficient for requirements.

Eastern Counties.—Some slight loss of time through rain was reported among day labourers in *Lincolnshire, Norfolk and Suffolk*;

otherwise agricultural employment in this group of counties was regular, and, except for a little surplus of day labourers in parts of *Norfolk*, the supply of labourers was generally fully equalled by the demand. Some scarcity of men for potato planting was reported in the Brigg (*Lincolnshire*) Union, while there was also a scarcity of day labourers in the Mildenhall (*Suffolk*) Union.

Southern and South-Western Counties.—Regularity of employment was general, although in some districts a few day labourers lost a day or two through rain. There was only a moderate demand for day labourers in *Kent* and *Sussex*, but such work as spreading manure, threshing, planting potatoes, and hoeing provided a fair amount of work in other counties, and the supply of and demand for men of this class were generally about equal. A scarcity of men for permanent situations requiring Sunday work was reported in the Petworth (*Sussex*) Union, and there was also some scarcity of permanent men in districts of *Herefordshire, Worcestershire, Devon,* and *Cornwall.*

THE CORN MARKETS IN APRIL.

C. KAINS-JACKSON.

The decline in prices during April, 1910, has been in striking contrast with their advance in April of last year. The imports of breadstuffs for the first thirty-four weeks of last cereal year were below requirements, whereas those of the like period in the present season have exceeded retail demand.

Wheat.—The average price of British wheat has not declined, but the farmer has not been able to obtain that advance which the improved condition of his deliveries would, in a month of stable values, have enabled him to gain. The seasoned corn which has reached the April markets has included, moreover, a fair proportion of high quality and heavy grain; this has been markedly so in Kent, where local averages have frequently been 1*s.* 6*d.* to 2*s.* above the mean for the entire Kingdom. Low quality markets, like those of the far North, where under thirty shillings has been repeatedly accepted, have improved in position; thus Berwick on the 23rd was able to quote an average of 32*s.* 4*d.* per qr.

Mark Lane has recorded quite fair sales of British produce, but imported wheat has given way 1*s.* 6*d.* to 2*s.* in the period of five weeks from Easter to the last day of April. In American wheat the decline in futures has been 3*s.* per qr., but 2*s.* is the extent of the fall in U.S. and Canadian produce in granary. The new Indian crop has come on sale at 39*s.* or thereabouts. At the close of the month 40*s.* was accepted for Australian new crop freshly to hand, 38*s.* 6*d.* for Odessa Ghirka, and 38*s.* for Durum.

The quantity on passage increased by a quarter of a million on the month; from 3,900,000 to 4,150,000 qrs., while shipments for April were 438,000 qrs. from North America, 1,197,000 qrs. from South America, 2,731,000 qrs. from Russia, 190,000 qrs. from Europe S.E., 504,000 qrs. from India, and 910,000 qrs. from Australasia. The Indian shipments show a marked increase, and an early spring in Russia has enabled that Empire to send off before April was over large quantities of wheat which ordinarily do not reach the seaboard before May.

Since harvest, imports of breadstuffs, a term which includes flour, have been at the rate of 524,000 qrs. weekly, as compared with average weekly imports of 482,000 qrs. last season. About half a million qrs. appears to have been the retail want, so that, whereas by the end of April, 1909, the country was understocked by 612,000 qrs. or thereabouts, there is to-day a presumptive excess of about 816,000 qrs. Reduced supplies of home-grown wheat, however, modify these figures at present, in holders' favour, and a year ago larger deliveries from farmers modified them in aid of the buyer. But for the presence of a moderating influence in each season, prices must apparently have had much greater variations than have actually been recorded.

Flour.—The top-price has been reduced by one shilling, that of Hungarian has fallen 1*s.* 6*d.*, and all American and Canadian sorts can be purchased at some reduction. Town Households have been reduced in price by ninepence on the month. Country flour of fair average quality, such as "Roller White," is difficult to quote as there is nothing like selling on grade, but as a rule the value is not more than 4*s.* below that of London Town Households, or less than 2*s.* below it.

America in April shipped 395,000 sacks, which is not a large quantity, and the quantity on passage at the end of the month, 180,000 sacks, was also moderate.

Barley.—A decline of ninepence to a shilling in Russian feeding barley has brought it to a price which is decidedly attractive to buyers. Almost any leading feedingstuff may now be considered cheap when it gets down to five shillings per cental. British Barley has been a poor trade at low rates. The malting season is virtually over, and the market deliveries have included many very poor samples. The Russian exports of 1,474,000 qrs. were the only striking shipments of the month, which closed with 335,000 qrs. on passage.

Oats.—Large supplies of inferior La Plata oats of the new crop have been forced on an unwilling market, with the effect of lowering prices somewhat seriously for all samples not weighing more than 304 lb. Heavy oats have escaped depression; on the 23rd the satisfactory average of 20*s.* 4*d.* was recorded at Canterbury. Shipments for the month were 362,000 qrs. from South America and 583,00 qrs. from Russia. The quantity on passage on the 30th was 460,000 qrs.

Maize.—The fall in the price of American maize is somewhat remarkable, as supplies have not been large. The value of Russian and Argentine has been better maintained, and the steady market for maize from Natal, Burma, and India suggests the opening up of new sources of supply. The total sales of all sorts of maize since the beginning of autumn have probably been less than usual, as the consumption of this staple follows closely on the temperature. The period October 1–April 30 was marked by less cold than in an average season. Shipments for April were 464,000 qrs. from North America, 142,000 qrs. from Russia, and 234,000 qrs. from Europe S.E. There are, however, only 180,000 qrs. on passage to this country, the Continent having taken much more than its usual proportion of the total quantities shipped. The month closed with American at 24*s.* 3*d.*, La Plata at 26*s.* 9*d.*, and Russian at 26*s.* 6*d.* per qr.

Oilseeds.—In the last six days of April the downward tendency of

the markets extended to oilseeds, but these seeds, the basis of most important feedingstuffs, are still dear enough to inconvenience many owners of live stock. The month closed with cottonseed at £10 5*s*. per ton, linseed at 62*s*. to 65*s*. per qr., brown Calcutta rapeseed at 41*s*. per qr., and good Sesame at 15*s*. per cwt. Shipments of linseed in April were 452,000 qrs. from South America and 310,000 qrs. from India. On the last day of the month 250,000 qrs. of linseed, 16,000 qrs. of rapeseed, and 79,000 tons of cottonseed were on passage to this country.

Oilcake.—The demand of late has been small, cottonseed cake in especial being out of favour. There has also been an appreciable lull in the inquiry for soy bean cake. Prices at the close of the month included £9 per ton for the best linseed cake, £6 12*s*. 6*d*. for the best cottonseed cake, and six guineas for the best soy bean cake.

Various Feedingstuffs.—Beet sugar at 14*s*. 6*d*. per cwt. is in steady request on spot, but is offered for November delivery at substantially lower quotations. A fluctuation of 2*s*. per cwt., or say, 15 per cent., is normal in this trade over the period of any given year. Value is usually highest at about this season, and lowest in the last nine or ten weeks of the year. The month closed with feeding rice at 7*s*. 9*d*. to 8*s*. per cwt., with rye at 26*s*. to 28*s*. per qr., and with Indian Dari at 26*s*. per qr. Bran, middlings, sharps, and pollard were somewhat cheaper from the quotations with which the month commenced.

THE LIVE AND DEAD MEAT TRADE IN APRIL.

A. T. MATTHEWS.

Fat Cattle.—The general character of the supplies was good throughout the month, and the numbers on offer have been about normal. The demand has been remarkably steady, and prices have shown a gradually hardening tendency. Very few cattle of other breeds than the Shorthorn have been offered in London, but the supplies of these have been excellent, as usual, from the Eastern counties, and have met with ready purchasers at prices considerably above the general average of the country. Up to the end of the third week prime Shorthorns averaged 8*s*. 5¼*d*., and second quality 7*s*. 8¼*d*. per 14 lb. stone, showing an advance in about twenty-four of the principal English markets of 1¾*d*. in one case and 1*d*. in the other. The trade during the last week showed no signs of weakness, while in London Shorthorns easily fetched 7¾*d*. per lb. for prime quality, which was the highest point touched since the end of January.

The average for Herefords in all recorded English markets was 8*s*. 8*d*. and 7*s*. 11*d*. for first and second quality, and that of Devons, 8*s*. 6*d*. and 7*s*. 11*d*.

The drawbacks to stall-feeding of cattle during the past winter have been the poor quality of the hay and the high price of feeding-stuffs, but roots have been plentiful, and, on the whole, sellers appear very well satisfied with the season's results. A period of short supplies of prime cattle is generally expected before any grass-fed beasts will be available.

Veal Calves.—Calves, as usual at this time of year, have been rather

freely marketed. There was, however, a good demand, and the general average in about twenty-three English and Scotch markets was a fraction over 9*d.* for first and 8*d.* for second quality. This was a reduction of ½*d.* per lb. on the prices prevailing in March.

Fat Sheep.—There have been much heavier supplies in most markets. This is always the case towards the close of the turnip season and at the time when clipping becomes general. Not only are the numbers increased, but during March and April the sheep are rapidly putting on flesh, thus greatly adding to the aggregate weight of mutton coming to market. In spite of this fact, however, there has been no serious decline in values. Demand has continued healthy, and moderate concessions have been sufficient to clear markets. The general average for prime Downs in the wool was 9½*d.* per lb. during the first week and the following two weeks it stood at 9*d.*, while shorn tegs of the same quality averaged 7¾*d.*, and 7¼*d.* in the second and third weeks. In the last week London was firm, Wakefield and Salford were reported dearer, though a slightly easier tendency was experienced at Derby and Newcastle. That there should have been only such a slight decline at a time when so many turnip-fed sheep have to be disposed of, indicates a strong consumptive demand and points to a continuance of the improved values during the coming summer.

Fat Lambs.—Lambs were officially quoted in over thirty markets and the general trade in them was good. They have realised an average of 1*s.* per lb. for first and 10¾*d.* for second quality. Values have differed widely at the various markets, first quality ranging from 10½*d.* to 1*s.* 3*d.* per lb. In the third week London, Exeter, Bristol, Hereford, and Shrewsbury were the lowest, while amongst the dearest were Carlisle, Preston, York, and Salford. In Scotland fat lambs were very dear.

Fat Pigs.—In the first two weeks fat pigs continued to sell at extreme rates, prime bacon pigs realising an average of 8*s.* 1¼*d.* per 14 lb. stone in about twenty-nine leading markets. Warmer weather caused a check in the third week, and prices receded to the extent of 2*d.* per stone.

Carcase Beef—British.—The trade in British meat was very steady, and prices for Scotch scarcely changed from week to week till an advance of ¼*d.* per lb. took place about the 26th. Till then prime short sides realised 7*d.* and whole sides 6½*d.* per lb. It was the subject of much remark that Scotch beef should be worth no more than port-killed American, as was the case during the last week, the quality being certainly as good as usual. Some very fine Norfolk beef also fetched 6½*d.* per lb. in the third and fourth weeks.

Port-Killed Beef.—Supplies of American beef killed at ports of landing were very small, and prices, relatively, extremely high. For the first three weeks the best sold at 6¼*d.* per lb., and in the last week 6¾*d.*, or ¼*d.* per lb. more than the best English. It would be difficult to explain to the general reader why this should be so. Certainly it was not owing to its superior quality.

Chilled Beef.—There were very heavy supplies of chilled beef from Argentina, but those from the United States were very moderate. There was but little fluctuation in the prices quoted, but a large proportion of the Argentine arrivals was of third-rate quality and sold at very low rates.

Frozen Beef.—For about half the month, "hard" beef was virtually crowded out of the market by the lower qualities of the chilled, and the prices quoted were really almost nominal. These were from $3\frac{3}{4}d.$ to $4\frac{1}{4}d.$ per lb. for hind quarters, and about $\frac{3}{8}d.$ less for forequarters.

Carcase Mutton—Fresh Killed.—Scotch and English mutton was a quiet and featureless trade in the London Central Market, and prices ruled in proportion to those of the live-stock markets. Prime Scotch fetched from $7\frac{1}{4}d.$ to $7\frac{3}{4}d.$, and best English $7d.$ to $7\frac{1}{2}d.$ per lb.

Frozen Mutton.—Salesmen complained of the slowness of the demand, and prices varied very little from those of March. The finest New Zealand sold at $4d.$ to $4\frac{1}{2}d.$ per lb.

Carcase Lamb.—The London demand was quiet throughout. Prime English touched 1*s.* per lb. in the first week, but did not afterwards exceed 11*d.*

Veal.—Supplies fully equalled demand, and $7\frac{1}{2}d.$ per lb. was not exceeded for English. Some prime small Dutch occasionally sold at 8*d.*

Pork.—There was some shortage, and prices remained high for the time of year. Prime small English ranged between $7\frac{1}{2}d.$ and $8\frac{1}{4}d.$ per lb.

THE PROVISION TRADE IN APRIL.

HEDLEY STEVENS.

Bacon.—The month's trading has again been unsatisfactory, both in regard to quantity consumed and profits realised by merchants and retailers. The curtailment in consumption on account of the extremely high prices has been more apparent, and merchants, finding their stocks accumulating, reduced their prices with a view to forcing the demand, but their efforts were attended with very little, if any, success. Danish and Canadian mild cured meats have fallen from 8*s.*–9*s.* in price during the month, and some cuts of American show a reduction of from 4*s.*–5*s.* per cwt.

During the month there was quite a reaction in the prices of all hog products in the United States owing to a slight increase in the number of hogs marketed, but more especially to a determined effort on the part of packers to force lower prices. There has also been a slackening in the consumptive demand on account of the arrival of fresh vegetables and eggs. Some packers, finding the business so unprofitable, have ceased killing, closing their houses for a time until hogs can be bought at more normal prices. At Chicago on April 1st the top price was $\$10.92\frac{1}{2}$, but by April 18th the top figures were \$8.80. The highest price for the same month last year was \$7.55, and two years ago it was \$6.20.

Shipments from the United States show further reduction, and for one week during the month a further record was established, when only 3,300 boxes were shipped to Liverpool, and, as no forward sales are being made, it is confidently expected that these figures will show still further reductions. The same remarks apply to Canada, and as the product of this country is still realising by sale in England several shillings under cost, doubtless there will be further curtailment in the arrivals from this source.

American lard experienced a big slump during April, the reduction in price being from 10*s.*–11*s.* per cwt. in about twelve days, resulting in operators making some heavy losses. By the end of the month prices had somewhat recovered.

English pigs are also cheaper. Curers could not make any headway with their sales, and were forced to reduce prices to enable them to come more into line with the market value of Danish and other Continental goods.

Cheese.—At the beginning of the month holders were very firm at the advance in prices secured at the end of March, but the consumptive demand continued very slow, and with the continued heavy arrivals of New Zealand, merchants showed some anxiety to keep their stocks moving, resulting in spot prices being 1*s.*–2*s.* per cwt. lower by the end of the month.

Canadian shippers offered new fodder makes over the cable at less money, and by the end of the month, purchases could be made at 57*s.* c.i.f., but with first Government grade New Zealands being offered on spot at around 59*s.*–60*s.*, importers were not inclined to pay the price demanded for fodder makes. The final shipments from New Zealand now on the way are much in excess of last year.

Advices from Canada report an early spring, with prospects of plenty of grass, but on account of the large quantities of fresh cream still being sent into the United States under the reduced tariff, it is not anticipated that the early make of butter or cheese will be large. Stocks of old cheese in Canada are now practically cleared, except what may be required for home consumption.

In the United States prices of fancy old makes remain unaltered, say around 82*s.*, but fodder makes could be bought at around 62*s.*–64*s.* The demand was poor.

At the end of the month the estimated stocks of Canadian cheese at the three principal distributing centres (London, Liverpool, and Bristol) were 116,000 boxes, against 95,000 last year, and 134,000 two years ago.

There has been a fair demand for English cheese, and prices remained steady, as, on account of the cold winds and especially cold nights, there will be less early English and Scotch cheese manufactured.

Butter.—Throughout the entire month the demand has been very slow, the continued large weekly arrivals from Australia and New Zealand being very much against the current high prices.

Values were steady at the commencement of the month, but a slump set in during the third week, and by the end of the month prices had dropped 10*s.* to 12*s.* per cwt., and holders showed great anxiety to reduce still further their stocks. On account of pasturage being very backward on the Continent, supplies from that source are not large, otherwise prices would show still further reductions. Secondary qualities continue scarce, and in consequence, command relatively high prices.

There are no arrivals from Canada or the United States, prices being far too high for export. In the middle of April, on account of extreme scarcity in New York City, as high as 166*s.* per cwt. was being paid for fancy selections.

By the end of the month arrivals from Ireland were more free, but below the average for the time of year.

Eggs.—The production in England and Ireland has been large during the month, but with the Continent busy pickling supplies for the winter trade, and consequently smaller imports, prices have remained fairly steady.

PRICES OF AGRICULTURAL PRODUCE.

Average Prices of Live Stock in England and Scotland in the Month of April, 1910.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	England.		Scotland.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
Fat Stock:—	per stone.*	per stone.*	per cwt.†	per cwt.†
Cattle:—	s. d.	s. d.	s. d.	s. d.
Polled Scots	8 9	8 3	40 5	37 0
Herefords	8 8	7 11	—	—
Shorthorns	8 6	7 9	39 3	36 4
Devons	8 6	7 11	—	—
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	9	8¼	9¼	7¼
Sheep:—				
Downs	8¾	8	—	—
Longwools	8	7¼	—	—
Cheviots	9½	8½	9¾	8½
Blackfaced	9	8	9	8
Cross-breds	8¾	7¾	10	8¾
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs:—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	8 0	7 6	8 1	7 2
Porkers	8 4	7 10	8 4	7 5
Lean Stock:—	per head.	per head.	per head.	per head.
Milking Cows:—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	21 12	17 18	22 3	17 17
,, —Calvers... ...	21 1	17 10	19 0	16 19
Other Breeds—In Milk ...	18 7	15 11	18 17	16 0
,, —Calvers ...	—	11 4	18 14	16 0
Calves for Rearing	2 9	1 17	2 17	2 0
Store Cattle:—				
Shorthorns—Yearlings ...	10 6	8 15	10 19	9 2
,, —Two-year-olds...	14 17	12 14	16 12	13 10
,, —Three-year-olds	18 12	15 16	19 7	15 1
Polled Scots—Two-year-olds	—	—	17 10	15 2
Herefords— ,,	15 16	14 12	—	—
Devons— ,,	14 7	12 16	—	—
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	44 4	37 9	—	—
Scotch Cross-breds ...	—	—	35 4	29 4
Store Pigs:—				
Under 4 months	31 7	26 0	28 6	21 6

* Estimated carcase weight.

† Live weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND and SCOTLAND in the Month of April, 1910.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Quality.	Birmingham.		Liverpool.		London.		Manchester.		Edinburgh.		Glasgow.	
		per cwt.		per cwt.		per cwt.		per cwt.		per cwt.		per cwt.	
		s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
BEEF:—													
English	1st	58	6	60	6	60	0	57	6	57	0*	58	6*
	2nd	54	6	56	0	57	0	55	6	52	6*	55	0*
Cow and Bull ...	1st	50	6	49	6	46	0	50	6	48	6	50	0
	2nd	46	0	42	6	39	6	46	0	43	0	42	0
U.S.A. and Canadian:—													
Port Killed ...	1st	58	6	59	6	59	6	57	6	—		—	
	2nd	—		55	6	56	0	55	0	—		—	
Argentine Frozen—													
Hind Quarters...	1st	40	6	39	6	39	6	39	6	40	6	36	6
Fore ,, ...	1st	35	6	34	6	35	0	34	6	35	0	33	0
Argentine Chilled—													
Hind Quarters...	1st	44	6	43	0	45	0	43	0	44	6	45	6
Fore ,, ...	1st	36	6	34	6	36	0	34	6	36	6	36	0
American Chilled—													
Hind Quarters—	1st	—		61	0	61	0	62	6	63	0	—	
Fore ,, ...	1st	—		42	6	43	6	43	6	—		—	
VEAL:—													
British	1st	67	6	78	6	67	6	77	0	—		—	
	2nd	62	0	70	0	63	0	71	0	—		—	
Foreign	1st	—		70	0	69	0	70	0	72	6	—	
MUTTON:—													
Scotch	1st	—		83	0	70	0	83	6	70	6	79	6
	2nd	—		77	6	67	6	79	6	62	0	70	0
English	1st	69	0	77	0	65	6	77	0	—		—	
	2nd	59	0	71	0	64	0	69	6	—		—	
Argentine Frozen ...	1st	38	0	36	6	37	6	37	6	38	0	36	0
Australian ,, ...	1st	36	0	34	6	34	6	34	6	36	0	36	0
New Zealand ,, ...	1st	—		—		39	0	—		—		—	
LAMB:—													
British	1st	98	0	99	0	102	6	100	6	—		—	
	2nd	91	0	—		92	0	—		—		—	
New Zealand ...	1st	54	0	54	0	52	0	54	0	57	0	56	6
Australian	1st	49	0	48	6	47	0	49	0	—		48	6
Argentine	1st	49	0	49	0	45	6	49	6	48	0	48	0
PORK:—													
British	1st	70	0	65	6	73	0	66	6	67	0	68	0
	2nd	64	0	60	6	67	6	62	0	57	6	65	6
Foreign	1st	—		—		70	0	—		—		—	

* Scotch.

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1908, 1909 and 1910.

Weeks ended (*in* 1910)	Wheat.			Barley.			Oats.		
	1908.	1909.	1910.	1908.	1909.	1910.	1908.	1909.	1910.
	s. *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
Jan. 1 ...	35 1	32 0	33 3	26 9	26 7	25 1	18 4	17 4	17 4
,, 8 ...	35 2	32 9	33 6	26 9	26 11	24 11	18 3	17 5	17 2
,, 15 ...	35 5	32 8	33 8	27 1	27 1	24 11	18 5	17 5	17 7
,, 22 ...	35 6	33 2	33 9	26 11	27 3	24 11	18 5	17 8	17 6
,, 29 ...	35 0	33 0	33 6	26 11	27 6	25 0	18 4	17 9	17 4
Feb. 5 ...	34 3	33 4	33 7	26 9	27 7	24 10	18 3	17 10	17 7
,, 12 ...	33 1	33 8	33 4	26 9	27 8	24 9	18 0	17 11	17 11
,, 19 ...	32 6	34 1	33 0	26 5	27 11	24 6	17 11	18 0	18 0
,, 26 ...	30 11	34 5	32 7	26 3	28 0	24 2	17 8	18 0	17 10
Mar. 5 ...	30 5	34 10	32 7	26 1	27 11	24 6	17 8	18 2	18 1
,, 12 ...	31 3	35 8	32 6	26 0	28 4	24 1	17 10	18 2	18 0
,, 19 ...	31 7	35 9	32 6	26 2	28 0	23 6	17 11	18 5	18 0
,, 26 ...	31 4	36 0	32 9	25 10	28 0	23 7	17 10	18 6	17 11
Apl. 2 ...	31 3	36 5	33 0	25 5	27 10	23 8	17 9	18 8	18 0
,, 9 .	31 2	37 4	33 6	25 10	28 0	23 1	17 7	18 10	17 11
,, 16 ...	30 11	38 7	33 7	26 1	27 8	23 5	17 7	19 2	18 3
,, 23 ...	30 10	41 4	33 7	25 5	28 2	23 0	17 9	19 9	18 3
,, 30 ...	31 6	42 5	33 0	25 8	27 10	22 10	18 0	20 0	18 3
May 7 ...	32 4	40 9	32 6	25 5	27 7	22 7	18 4	20 3	18 2
,, 14 ...	33 1	41 6		24 9	27 3		18 7	20 6	
,, 21 ...	33 8	42 8		25 9	27 0		18 10	20 11	
,, 28 ...	33 5	42 6		24 6	26 3		18 8	21 0	
June 4 ...	33 1	43 1		25 10	25 7		18 4	21 3	
,, 11 ...	32 7	42 11		24 5	26 10		18 4	21 4	
,, 18 ...	32 0	42 7		24 2	26 10		18 5	21 6	
,, 25 ...	31 5	42 8		24 0	27 2		18 7	21 7	
July 2 ...	30 11	42 9		23 11	27 2		18 7	21 9	
,, 9 ...	30 5	43 0		24 4	26 4		18 5	21 8	
,, 16 ...	30 7	43 3		23 1	26 10		18 5	21 9	
,, 23 ...	31 5	44 0		26 5	27 4		18 6	22 5	
,, 30 ...	31 10	43 5		24 4	24 6		18 7	22 2	
Aug. 6 ...	31 6	44 9		23 1	27 4		18 9	22 11	
,, 13 ...	31 6	44 9		23 10	24 9		18 1	21 8	
,, 20 ...	31 2	41 6		24 5	23 11		17 10	19 8	
,, 27 ...	30 10	38 5		24 5	24 7		17 1	19 4	
Sept. 3 ...	30 10	37 2		25 5	26 3		17 3	19 6	
,, 10 ...	31 5	34 11		25 11	26 1		17 6	18 5	
,, 17 ...	31 7	33 6		26 0	26 5		17 3	17 9	
,, 24 ...	31 5	32 9		26 8	26 8		17 2	17 7	
Oct. 1 ...	31 7	32 2		26 11	26 9		17 2	17 2	
,, 8 ...	31 5	31 8		27 5	26 9		17 0	17 0	
,, 15 ...	31 2	31 4		27 6	27 0		17 0	17 0	
,, 22 ...	30 11	31 8		27 5	27 7		16 11	16 11	
,, 29 ...	30 8	31 10		27 5	27 9		16 11	17 0	
Nov. 5 ...	30 11	32 5		27 6	27 9		17 0	17 0	
,, 12 ...	31 2	32 5		27 4	27 7		17 0	17 1	
,, 19 ...	31 10	32 7		27 3	27 0		17 3	17 4	
,, 26 ...	32 3	33 0		27 2	26 8		17 5	17 3	
Dec. 3 ...	32 7	33 3		27 2	26 1		17 4	17 4	
,, 10 ...	32 8	33 3		27 0	25 7		17 4	17 3	
,, 17 ...	32 9	33 2		26 9	25 3		17 3	17 4	
,, 24 ...	32 2	33 1		26 8	25 2		17 2	17 4	

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lbs.; Barley, 50 lbs.; Oats, 39 lbs. per Imperial Bushel.

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE, BELGIUM, and GERMANY, and at PARIS, BERLIN, and BRESLAU.

—		Wheat.		Barley.		Oats.	
		1909.	1910.	1909.	1910.	1909.	1910.
		s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
France:	March	39 4	41 11	26 5	25 11	21 0	21 10
	April	40 1	42 2	26 9	25 11	22 0	21 10
Paris:	March	37 11	43 1	23 3	24 8	20 11	21 6
	April	40 6	43 0	23 3	24 8	20 11	22 1
Belgium:	February	36 0	36 7	26 1	23 6	19 10	19 7
	March	37 1	35 10	26 4	23 10	20 3	19 8
Germany:	February	44 9	45 11	29 6	25 10	22 6	21 6
	March	47 8	45 7	30 8	25 9	23 11	21 3
Berlin:	February	47 0	48 9	—	—	23 9	23 1
	March	49 5	48 0	—	—	24 9	22 5
Breslau:	February	42 1	45 7	30 8 (brewing) 26 0 (other)	25 4 (brewing) 24 2 (other)	21 4	20 6
Breslau:	March	44 3	44 8	31 6 (brewing) 26 0 (other)	25 4 (brewing) 24 2 (other)	22 5	19 11

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*, the prices for the German Empire representing the average of the prices at a number of markets.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of April, 1909 and 1910.

—	Wheat.		Barley.		Oats.	
	1909.	1910.	1909.	1910.	1909.	1910.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
London...	39 0	34 1	27 5	22 5	19 10	18 5
Norwich	37 9	33 1	28 0	23 4	19 0	17 9
Peterborough	39 4	32 7	26 8	21 5	20 0	17 11
Lincoln...	38 6	33 0	27 10	20 9	19 0	18 4
Doncaster	37 0	33 0	28 2	23 0	18 7	18 4
Salisbury	40 3	33 9	28 6	23 5	18 8	17 9

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND and SCOTLAND in the Month of April, 1910.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Bristol.		Liverpool.		London.		Glasgow.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British ...	15 0	14 0	—	—	14 9	13 6	15 6	—
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery	123 6	—	119 0	116 6	120 0	116 0	120 6	—
,, Factory	117 6	—	110 0	106 0	115 0	113 0	—	—
Danish ...	—	—	125 0	122 6	125 0	122 6	124 6	—
Russian ...	121 0	119 0	118 6	116 0	118 6	116 6	120 0	115 6
Australian ...	120 6	117 6	118 0	116 0	117 0	115 0	119 6	118 6
New Zealand	122 6	120 0	120 6	119 0	119 6	117 6	121 6	—
Argentine ...	121 0	119 0	118 0	115 6	119 0	115 6	118 6	—
CHEESE :—								
British—								
Cheddar ...	75 6	63 6	74 0	72 0	79 0	73 0	63 0	57 0
			120 lb.	120 lb.	120 lb.	120 lb.		
Cheshire ...	—	—	72 6	68 0	77 6	67 6	—	—
			per cwt.	per cwt.	per cwt.	per cwt.		
Canadian ...	64 0	62 6	64 0	61 0	66 0	63 0	63 0	60 0
BACON :—								
Irish	77 6	74 6	74 0	71 0	73 6	65 0	78 6	74 6
Canadian ...	73 0	71 0	70 0	67 6	71 6	—	74 6	72 6
HAMS :—								
Cumberland ...	—	—	—	—	112 6	103 0	—	—
Irish	—	—	—	—	108 6	99 6	106 0	98 0
American (long cut) ...	79 6	76 6	80 6	75 6	76 0	74 6	80 6	78 6
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British ...	8 4	7 6	—	—	8 11	8 4	—	—
Irish	7 9	7 4	7 8	7 0	8 4	7 10	7 2	6 6
Danish ...	—	—	7 7	—	9 1	7 6	7 10	7 1
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Langworthy ...	68 6	60 0	80 0	75 0	80 0	62 6	68 6	60 0
Scottish Triumph	70 0	60 0	50 0	46 6	68 6	60 0	—	—
Up-to-Date ...	73 6	60 0	50 0	46 6	70 0	60 0	61 0	56 0
HAY :—								
Clover ...	92 6	77 6	110 0	80 0	103 0	78 0	82 6	77 6
Meadow ...	77 6	62 6	—	—	91 0	66 6	—	—

DISEASES OF ANIMALS ACTS, 1894 to 1909.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

Disease.	April.		Four Months ended April.	
	1910.	1909.	1910.	1909.
Swine-Fever:—				
Outbreaks	113	194	410	560
Swine Slaughtered as diseased or exposed to infection ...	1,274	2,010	3,484	5,219
Anthrax:—				
Outbreaks	146	158	556	517
Animals attacked	168	187	680	705
Glanders (including Farcy):—				
Outbreaks	40	75	134	222
Animals attacked	66	361	328	883
Sheep-Scab:—				
Outbreaks	19	42	301	412

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)

Disease.	April.		Four Months ended April.	
	1910.	1909.	1910.	1909.
Swine-Fever:—				
Outbreaks	18	4	29	12
Swine Slaughtered as diseased or exposed to infection ...	516	46	812	117
Anthrax:—				
Outbreaks	—	—	4	2
Animals attacked	—	—	6	2
Sheep-Scab:				
Outbreaks	46	35	299	262

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BABY BEEF.

K. J. J. Mackenzie, M.A.

University Lecturer in Agriculture, Cambridge.

The term "baby beef" is used to indicate as tersely as possible the faculty of early maturity in cattle which are wanted for beef production. For the last hundred and fifty years our breeders of horned stock have constantly endeavoured to hasten the early development of their animals, and the object of this paper is to put before the reader the question of the advisability of taking full advantage of the extraordinary power which is possessed in this respect by well-bred cattle of the British "beef" breeds.

Food Required for Sustenance and for Increase in Weight.—There are two main objects to be attained when an animal is being fed for beef production, viz.: (*a*) it has to be kept alive, and (*b*) it should gain in weight as much as possible. In this paper the first of these objects will be referred to as *sustenance,* while the gain in weight will be spoken of as *increase.*

Very little consideration is necessary in order to appreciate what a large amount of material is used up for sustenance. In the first place, much of the food is utilised simply to supply warmth; while another large portion of it is required to supply power in order that all the muscular exertion required by every action of the body may be sustained.

A large bullock put up to fatten will want about 100 lb. of food a day for sustenance and increase, and of this about 75 lb. will be used for sustenance and 25 lb. for increase.

If it is fed upon 8 lb. of linseed cake, 10 lb. of hay, and 82 lb. of roots, we find, using the figures given in Warington's "Chemistry of the Farm," that the food has been employed somewhat as follows:—For increase: 2 lb. cake, 5 lb. hay, 20 lb. roots. For sustenance: 6 lb. cake, 5 lb. hay, 62 lb. roots.

In order, therefore, to obtain the greatest possible profit from animals wanted for beef, it is necessary to "keep them moving." If for any length of time they stop growing heavier, no return is then being given for the money spent on their sustenance. In other words, a beast that is wintered in a strawyard on an allowance of food which merely keeps it alive is doing nothing to help pay for all the money and trouble that is being expended upon it.

Yield of Meat in Animals of Different Ages.—In the case of beef-making, young animals give, considering the food they consume, a greater proportionate increase than do older ones; or, in other words, the greater the age of the animal, the greater is the proportion of the food required for sustenance, and the smaller the increase obtained. This is shown by the following figures, which are taken from the published accounts of the Smithfield Carcass Competition, and represent results obtained from five breeds, namely, Shorthorns, Herefords, Aberdeen Angus, Sussex, and Devons. The weighings were obtained in eight years from:—

77 yearlings	slaughtered at about	22	months	old.
89 two-year olds	,, ,,	33	,,	,,
54 three-year olds	,, ,,	44	,,	,,

As regards yearly increase, we find the yearlings (live-weight 1,344 lb.) gave an average of 63 stones (of 14 lb.) and 5 lb. of beef each, or at the rate of 34½ stones per 12 months of life. The two-year-olds (live-weight 1,750 lb.) yielded 84 stones 7 lb. of beef, which gives a rate of 30¾ stones per 12 months; while the three-year-olds (live-weight 2,112 lb.) gave 96 stones, or at the rate of only 26⅕ stones per 12 months.

The financial advantage of selling early may be seen from the following table, in which the prices realised per month of life for the youngest and oldest animals sold at Mr. R. Bond's Auction Sales at the Ipswich Fat Cattle Shows are given for three years and four years respectively:—

Year.	Age.	Live-weight.	Weight of Dressed Carcass.	Per-centage of Carcass to Live-weight.	Price realised at Sale.	Price realised per month of life.
	Yrs. m. d.	Cwt. qr. lb.	Cwt. qr. lb.		£ s. d.	£ s. d.
1904	1 0 0	9 0 2	5 1 6	58·8	21 0 0	1 15 0
1905	1 0 14	9 0 6	4 3 0	52·5	18 0 0	1 8 10
1907	1 1 20	11 2 12	7 0 4	60·6	22 10 0	1 12 11
Average of youngest	1 1 20	9 2 25	5 2 16	58·0	20 17 0	1 10 7
1904	1 8 13	11 1 16	7 1 2	64·6	26 0 0	1 5 5
1905	1 5 0	10 3 16	6 3 8	62·6	24 10 0	1 8 10
1907	1 9 4	9 2 13	5 1 26	57·0	21 0 0	0 19 11
1908	1 9 14	11 3 18	7 0 6	59·2	28 10 0	1 6 7
Average of oldest	1 8 0	10 3 23	6 2 17	60·7	25 0 0	1 5 0

It will be noticed that in the case of animals whose average age is just over 13 months, the return per month is 5*s.* 7*d.* more than in the case of beasts just 20 months old.

It is interesting to express the Smithfield figures already quoted in pounds, shillings, and pence. Unfortunately the selling price is not available, so that the amount realised per stone has to be estimated, but it may be assumed for the purposes of comparison that all the cattle were sold at 8*s.* per stone of 14 lb. carcass weight.

In the case of the yearlings, *i.e.*, beasts slaughtered at about 22 months old, for twelve months' keep we get 34½ stones' worth at 8*s.*=£13 6*s.* The two-year-olds, *i.e.*, animals that lived 11 months longer, gave an increase of 21 stone, so that for about another year's feeding we should receive £9 3*s.* Going a step further, we find that the three-year-old for a further 11 months' feeding gives an increase of 12 stone. This is at the rate of under £5 5*s.* for the last 12 months' feeding.

The following table sets out the facts more clearly :—

Age of Beasts.	Percentage of Dead to Live-weight.	Carcass Weight.	Value of Meat.	Increase of value for last twelve months (calculated).
Months.		Stone.	£ s. d.	£ s. d.
22	66·0	63	25 4 0	13 15 0
33	67·5	84	33 12 0	9 3 0
44	68·2	96	38 8 0	5 5 0

Unfortunately, the Smithfield Show does not include beeflings or calves ready at about 12 months old, and it is to them more especially that I refer when speaking of baby beef. I have, however, some particulars of five such animals —only one being a show beast—and these animals averaged 8 cwt. live weight at just under 12 months old. Assuming that they would only average 57 per cent. of carcass weight to live weight,* they would give a return of 36 stone for each beast. This would give us £14 8*s*. for the first 12 months of life.

These figures may be compared with the results of certain American experiments with regard to the cost of raising beef to different ages, which showed that while it cost 15*s*. to produce 100 lb. of live-weight on a calf from 1 to 12 months old, the cost of producing the same weight on animals from 12 to 24 months old was 30*s*., and with animals from 24 to 36 months of age it was 45*s*.

Advantages of Early Maturity.—There are further advantages to be got by having young stock ready early. The animal that is ready at 12 months old can go to market then, or, if necessary, can be kept for a favourable opportunity. He will do well till he is 18 months old, and this allows 6 months in which to catch a market. If, on the other hand, we take a 30 months old bullock and do him well for, say, 24 weeks, the animal must be sold then even if the market is against us, as after that period of forced feeding nearly all his food will go for sustenance, and his increase of weight will be but small. A further reason for selling early is that in the case of small prime beef there is less competition from the foreigner, who has not the same facilities for the production of baby beef.

Having now spoken of the advantages, we must enumerate some of the disadvantages alleged against the system. It is said to demand better stock than is required for other methods of raising beef. It is, however, a fact that decently bred animals of our beef breeds will answer the purpose, and Mr. H. Evershed † has shown how calves from ordinary large

* Young cattle do not yield so well as older beasts, though in one of the instances before me, that of a Sussex, the return was actually 60 per cent.

† *R.A.S.E. Journal*, 1890, p. 60.

deep milking cows will do provided they are got by a good bull. The system also requires rather more complicated cropping. The calf-flesh must never be lost, and this entails the production of green and succulent fodder-plants all the year round in those districts where there are not good, cool-bottomed, well-sheltered paddocks in which the calves can run. It also entails care and skill in rearing the calf, and generally, like every other profitable system, involves a considerable amount of trouble.

Systems of Rearing "Baby Beef."—The simplest method is that of the breeding cow and running calf, but even if one supposes two calves put on each cow in the herd, this system is not very profitable. This is at once evident if we consider what it costs to keep a cow, and reflect that the *most* we can expect for one year's maintenance is two calves of about five months old, one of which has been bought for, say, two pounds. This system requires a good deal of grass-land, and unless it is cool and thoroughly well sheltered the calves lose a large proportion of their flesh galloping about when worried by the fly in the summer. Again, calves so reared are apt to be wild, and do not settle well in their boxes when put up to fatten away from their mothers.

I should, however, like to give an example of what can sometimes be done on this system. The animal in question was an Aberdeen Angus on the University Farm at Cambridge. At one year and nine months old this heifer weighed 1,225 lb., or just under 11 cwt., and was sold for £24. It was estimated that she would yield 54 stones (of 14 lb.) of meat, so that at 8*s*. she would have made £21 12*s*. This heifer ran out with her mother on grass till about six months old. She then wintered for six months, getting, besides the usual hay and straw and roots, about 2 lb. of mixed cake and corn per diem, and the following summer ran out on good but not "finishing" grass. During this summer she got no cake, but in the autumn she was for about three months in the boxes on from 4 lb. to 5 lb. of mixed cake, and the usual allowance of hay, straw, and roots.

Another system is that of feeding out a heifer and her first calf together. If one has some nice shaded grass, some properly sheltered yards, and plenty of straw and roots for heifers

in calf, this is an excellent system provided that we can find suitable buildings on a farm. From the time the calf is dropped, heifer and offspring are kept in a box and fattened out together, when the calf is about 12 months old. I have known many cases where the fat heifer and beefling have left £1 10*s*. a month for their keep. Good heifers ready to "bull" can be bought for £11, allowing £3 for their nine months' keep, *i.e.*, five months aftermath and winter grazing, and four months in the straw-yard. The couple at birth of calf might be invoiced at £14; after 12 months' keep the yearling might well be expected to return £15, and the heifer could be counted on to yield another £17. Expenditure on cake and corn might be managed so as not to cost more than £10 for the pair for the year. At this rate £8 would be left for hay, straw, roots, or other fodder; and this certainly is a very much less expensive way of making dung than some other methods.

The objections to this system of feeding out are generally the want of proper accommodation, and sometimes the want of a good bull to put with the heifers, and without this last factor failure is almost certain.

It is necessary to dishorn calves that are kept in this way, as otherwise the heifers will wean them at about five months, whereas they ought to suck till they are nine months old, even if they only get a pint or two a day.

Baby Beef-making on the Pail.—In the *Journal* of the Royal Agricultural Society previously mentioned, Mr. H. Evershed gives an account of a system, and as I know the farm on which it was carried out, I propose to refer to it in some detail.

The farm consists of about 300 acres, of which only 15 were in grass. A few large deep milking cows were kept, and every year from 100 to 150 young bullocks went out at from 12 to 18 months old. In one year 170 bullocks went out at an average of 15 months (they ranged from 14 to 18 months, but very few were more than 15 months old). The average carcass weight of these 170 bullocks was 37 stones (of 14 lb.), which at 8*s*. a stone gives a value of £14 16*s*. each.

The calves were bought in, except the few from the above-mentioned cows, and the home-bred ones were found to do

the best of all. For the first four weeks of their lives the calves had, on an average, $1\frac{1}{2}$ gallons a day of whole milk, which makes a total of 42 gallons each. On this system calves must have some whole milk given them. For the next eight weeks $1\frac{1}{2}$ gallons of liquid was given, made up of half new milk and half water or skim milk, and boiled linseed and oatmeal as a cream equivalent. From the twelfth till about the sixteenth week pail-feeding went on even if skim milk were not available, for nourishing and palatable fluid was believed to be of great importance. At about 14 weeks old the calves would be getting $1\frac{1}{2}$ gallons of skim milk plus 1 lb. of boiled linseed and oatmeal gruel, or $1\frac{1}{2}$ gallons of water plus 2 lb. of gruel. This was gradually discontinued till at 4 months old the calves were on dry food, the best of hay having been supplied from the fifth week.

All through their first summer—that is to say, from the age of 4 to 7 months or so—the calves were in boxes made in old barns, very little litter being used, the feeding being all the green fodder crops they could consume without scouring, all the hay they would eat, and from 3 to 4 lb. a day of best linseed and bean meal, half and half per diem.

Six to nine months' autumn and winter feeding followed, when they received per diem $\frac{3}{4}$ to 1 bushel of cut roots, 4 to 6 lb. of cake and meal, and all the good hay they could eat. They were usually sold at about 13 months old, but if the market was against them they were fed on, receiving a little more cake and corn, though never more than 8 lb. a day, till prices improved. February was found to be the best month for the sale of this small beef, though June and July were also very favourable.

Mr. Evershed states that the success of the system depends largely upon the men being made to take an interest in the animals, and that the beasts should be fed regularly and never over-fed at any one time. While calves are being pail-fed their food must be kept scrupulously clean, and their stalls must also be kept clean and sweet, otherwise scour will spread, and then, he says, "good-bye to one's profit."

The difficulties in the way of anyone wanting to grow this early maturity beef must not be minimised, the greatest, perhaps, being that of obtaining a proper supply of good

calves; but where conditions are suitable it will be seen that it affords a good margin of profit.

A LIME-SULPHUR WASH FOR USE ON FOLIAGE.

E. S. SALMON, F.L.S.

Mycologist to the South-Eastern Agricultural College, Wye, Kent.

The object of this article is to direct the attention of farmers and fruit-growers to the fact that a summer wash for use against certain fungus diseases of plants can be prepared by boiling lime and sulphur together, and that this wash, unlike "flowers of sulphur" and the "liver of sulphur" solution, is not readily washed off by rain. Some experiments which have recently been carried out show that this lime-sulphur wash is efficacious against "powdery mildew," and the experience lately obtained in other countries indicates that in certain cases the wash may be useful in combating attacks of apple "scab" or "black spot."

Experimental Work.—The experiments carried out in connection with "powdery mildew" were briefly as follows. In one set of experiments young hop-plants affected with the well-known hop "mould," or mildew (*Sphaerotheca Humuli*) were treated in the following manner. A considerable number of leaves were chosen which bore patches of the mildew in a powdery and actively growing condition; each leaf was then divided by a line down its midrib into two halves. Each half of these selected leaves bore from one to four patches of mildew. One half of each leaf was painted over with the lime-sulphur wash, while the other half—which served as a "control" or check—was either left untreated or was painted over with pure water. In every case the patches of mildew on the treated half of the leaf were killed—the spawn (*mycelium*) of the mildew drying up, but not changing colour; on the other half of the leaf the mildew continued to increase rapidly. Further, no fresh infection took place on the treated half of any of the leaves, although spores (*conidia*) must have constantly been blown there from the powdery patches on the untreated part of the leaf. In one series of experiments investigations were made with

regard to this point. Healthy young hop-plants were chosen, and one half of some of the leaves was treated with the lime-sulphur wash. Spores (*conidia*) of the hop-mildew were then sown on both the treated and untreated halves of each leaf. In no case did any infection take place on the treated part of the leaves, while (under the conditions of the experiment) the untreated half of the leaves became virulently infected, and after fourteen days bore numerous powdery patches of "mould."

In another series of experiments a number of young hop-plants which were all beginning to be infested with hop "mould," were divided into two sets of equal numbers, each set being, so far as the eye could judge, equally affected with the mildew. In each experiment one set of plants was well sprayed with the lime-sulphur wash—using a Vermorel nozzle on an "Eclair étamé" knapsack. A fine misty spray was obtained, and the leaves of the treated plants appeared, when the spray had dried on them, as though uniformly dusted over with a fine, whitish, closely-adhering dust. The same result was obtained as in the first experiments mentioned above, *i.e.*, the "mould" died away on the sprayed leaves, and, in those cases where the sprayed plants stood apart from the unsprayed plants, the "mould" did not appear on the fresh growth. During the time of the experiment the "mould" continued to increase on the unsprayed plants, and the fresh leaves of these, as they expanded, became infested.

In many of the above experiments frequent and heavy showers of rain fell on the sprayed leaves, but did not wash off the spray owing to its closely-adhering nature. There are reasons for believing that this lime-sulphur wash will be useful, under certain circumstances and weather conditions, for combating "powdery mildews" such as the American Gooseberry mildew (*Sphaerotheca mors-uvae*), Hop and Strawberry mildew (*S. Humuli*), Rose- and Peach-mildew (*S. pannosa*), Apple mildew (*Podosphaera leucotricha*), Cucumber mildew (*Erysiphe Cichoracearum*), and Pea mildew (*E. Polygoni*).

A lime-sulphur wash of the same strength as that used on the hop was also sprayed during May on the foliage of gooseberries, and of the following varieties of apples:—Cox's

Orange Pippin, Bismarck, Worcester Pearmain, Duchess' Favourite, Belle de Pontoise, and Golden Spire. No "scorching" of the foliage resulted. In the United States a lime-sulphur wash is being officially recommended by the Department of Agriculture for use against attacks of "scab," (or "black spot") on those varieties of apples (such as Ben Davis, Jonathan, Hubbardston) which are liable to be injured on their foliage or fruit by the use of Bordeaux mixture. As I have recently pointed out (see this *Journal* for May last), certain varieties of apples grown in this country are likewise liable to be injuriously affected by Bordeaux mixture—the foliage becoming "scorched," or yellowing and falling off, or the fruit becoming "russeted" or "rusty." In the case of these varieties, when they are threatened with attacks of "scab," the English apple-grower should use, *on an experimental scale,* the lime-sulphur wash here described.

Preparation of the Wash.—The lime-sulphur wash used in the above experiments may be made first in a very concentrated form by boiling together the following quantities of lime and sulphur:—

Quicklime (in lumps)	50 lb.
Flowers of Sulphur	100 lb.
Water	50 gallons.

This formula, as well as the method of making and diluting the wash which is described below, is that recommended in *Bulletin No. 92 of the Pennsylvania State College Agricultural Experiment Station.*

Some form of heating apparatus is necessary, such as a copper. Iron or zinc coppers are suitable, *but copper ones must not be used.*

Place 10 gallons of water in the copper, and start the fire. Add the 50 lb. of quicklime. When the slaking is well started, add the 100 lb. of sulphur gradually, and mix until a thin, even paste is formed, *taking care to break up all the lumps of sulphur as far as possible.* If too thick, a little more water can be added. When thoroughly mixed, add water up to the 50-gallon mark (using a measuring stick). Boil for one hour, adding water when necessary to keep it at the same level.

The wash thus prepared will be an orange-red liquid, consisting of a solution of sulphides and polysulphides of calcium, together with small amounts of other sulphur compounds. There will also be a small amount of insoluble lime and sulphur.

Strain through butter-muslin, and store *at once* where air cannot reach the liquid. This concentrated wash can be kept, until wanted for use, stored in completely filled and corked stone jars or in barrels. If in barrels, the surface of the fluid must be protected from the air by a layer of oil (mineral).

Before use as a spray on the foliage of plants the concentrated wash obtained as above requires to be diluted. The amount of dilution which is necessary in order to avoid "scorching," varies with the character of the foliage or plant to be sprayed, and can only be ascertained by experiment. In the experiments described above, a lime-sulphur wash having a specific gravity of 1·01 was used; this is obtained by adding from about 20 to 23 gallons of water to every gallon of the concentrated wash—according to the specific gravity of the latter, which will vary slightly. When diluted, the wash must be used at once. *Hydrometers* with a specially prepared scale and directions for use can be obtained, price 3*s*. 6*d*. each; by means of one of these instruments the specific gravity of the concentrated or diluted wash can instantly be ascertained. Under the conditions in the experiments described above a lime-sulphur wash of the specific gravity 1·01 produced no "scorching" on the leaves of the hop, gooseberry, or apple. On the young, tender foliage of roses in the greenhouse, "scorching" resulted with a wash of this strength; in such cases the wash should be used at half strength. It is possible that under certain weather conditions this weaker strength will be necessary for the hop, gooseberry, and apple also in order to avoid "scorching" the foliage. In all cases the lime-sulphur wash should be first used on an experimental scale, the specific gravity of the diluted wash (or the number of gallons of water added to each gallon of the concentrated wash) being carefully noted. A few plants should be sprayed with a wash having the specific gravity 1·01, and then, if necessary, further dilution with water should be made.

In the boiling together of the lime and sulphur a chemical

reaction takes place, bringing about the solution of the lime and sulphur. The best proportions of lime and sulphur to use are believed to be those given above.

After application to the leaves, the wash is acted upon at once by the atmosphere, with the result that sulphur is almost instantaneously deposited. The sulphur thus deposited is in an excessively fine state of division—the particles being many hundred times finer * than those of "flowers of sulphur" —and in consequence adheres, in the form of a whitish powder, so intimately to the surface of the leaf that rain will not wash it off. If sprayed leaves, when once the spray is dry, are placed under running water from a tap, it will be found that the whitish powder consisting of sulphur is not washed off.

The diluted lime-sulphur wash, which is a perfectly clear liquid, should be applied with a nozzle throwing a very fine "misty" spray. The same type of nozzle which is suitable for the application of Bordeaux mixture (see this *Journal* for January last) is suitable for the lime-sulphur wash. The receptacle of the spraying machine must be wooden or iron (galvanised iron or tin); a *copper* knapsack sprayer must not be used, as the wash acts chemically on this metal. Knapsack sprayers which are tinned over can be obtained. According to the results of experiments recently carried out in the United States, certain arsenical washes can be added to the lime-sulphur wash.

Summary.—A lime-sulphur wash, made as described above, of the specific gravity 1·01 is efficacious in combating the hop-mildew, and can be recommended for trial against other "powdery mildews," and also against "black spot" or "scab" on those varieties of apples which are liable to be injured by Bordeaux mixture. The lime-sulphur wash is cheap, and as a spray against mildews possesses two great advantages over the "liver of sulphur" solution, viz., (1) it does not readily wash off, (2) the deposition of sulphur which results makes it easy to see where the spray has reached, and if any parts of the tree or bush have been missed. It must be pointed out, however, that Bordeaux mixture is still

* The particles are so small that they will pass through filter-paper.

the best fungicide *for general use* against "black spot" or "scab," and that the lime-sulphur wash is not to be regarded as a substitute for it, but only as a spray to be used in certain special cases, viz., on those varieties of apples which are liable to "Bordeaux injury."

THE FINANCIAL ASPECT OF THE GROWTH OF SCOTS PINE.*

PERCIVAL T. MAW.

In view of the fact that extensive planting operations are advocated by many foresters, I feel convinced that any careful and logical consideration of the financial returns likely to be yielded by the planting of any particular crop will be welcomed by all who have bestowed any careful thought upon the possibility and advisability of any extensive schemes of afforestation, and by all who have at heart the true interests of British forestry; and this, too, even though the results at which I arrive are diametrically opposed to the opinions expressed by others.

Now, before it is possible to estimate the financial returns of any particular crop, it is necessary to put forward certain data, upon which all are agreed, as to the amount of timber which is likely to be produced in a specified time. Herein lies a great difficulty. I have myself published a number of yield tables † based upon measurements which I have taken in this country, but as they are not known to all, and as there are many foresters of the Continental school who pin their faith almost entirely to Continental methods and Continental results, it seems to me that, in certain quarters at any rate, it would eliminate the chief ground for adverse criticism if I based my argument entirely upon a Continental yield table.

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* In publishing this paper the Board must not be held to express an opinion on the conclusions reached. In the absence of reliable data based on observations drawn from trees grown in this country, calculations of the financial results of afforestation must be more or less speculative.

† In *The Practice of Forestry.*

With this object in view I have selected a German yield table, prepared by Schwappach,* for Scots Pine grown in a locality (in Germany) where the soil and situation are of average quality, and I think that most practical growers will readily acknowledge that such a yield is a fair criterion of what may be expected upon selected mountain land, not exceeding 950 ft. above sea-level. This table, however, gives the true mathematical contents, bark included. I have therefore made a deduction of 25 per cent. in order to arrive at the contents by quarter girth measurement, and a further deduction of one-eighth as an allowance for bark.† Then, again, I have valued the timber according to the scale shown on p. 191, which I think may be taken as a "top" price at the present time.

Now, from the particulars obtained as stated above, I have constructed the table given on p. 192, wherein I have calculated the percentage rate of increase both in volume of timber and in gross value which will take place successively during the intervals which elapse between each thinning; and I have also shown the rentals for the land which will be obtained at the same periods, and the accumulated capital sum which these land rentals represent.

In arriving at these land rentals—which it may be stated provide data which are directly comparable with annual rents received from agricultural land—I have assumed (1) that the original cost of planting, fencing, and cleaning the young crop for the first three years and replacing "deaths" is £5 per acre; (2) that the annual outgoings through the whole rotation, including rates, repairs to fences, roads, supervision, cutting out thinnings, &c., &c., are 3*s.* 6*d.* per acre; (3) that all items of income and expenditure are credited and debited with $3\frac{1}{2}$ per cent. compound interest to the end of the rotation, when the *net* monies then in hand are discounted into a yearly payment on the $3\frac{1}{2}$ per cent. tables.

* Quoted in Schlich's *Manual of Forestry*, vol. iii, p. 364.

† These deductions allow for the fact that, when measuring timber in this country, fractions of $\frac{1}{2}$-inch in quarter girth are omitted.

SCALE OF PRICES FOR SCOTS PINE TIMBER (SOLD STANDING).

Trees containing	under 4 cubic feet of timber (to 3 in. top diameter)					at 3*d.*	per ft.
,,	,,	4 c. ft. and under 6 c. ft.	,,	,,	,,	at $3\frac{1}{2}$*d.*	,,
,,	,,	6 ,, ,, 8 ,,	,,	,,	,,	at 4*d.*	,,
,,	,,	8 ,, ,, 10 ,,	,,	,,	,,	at $4\frac{1}{2}$*d.*	,,
,,	,,	10 ,, ,, 15 ,,	,,	,,	,,	at 5*d.*	,,
,,	,,	15 ,, ,, 20 ,,	,,	,,	,,	at $5\frac{1}{2}$*d.*	,,
,,	,,	20 ,, ,, 25 ,,	,,	,,	,,	at 6*d.*	,,
,,	,,	25 ,, ,, 30 ,,	,,	,,	,,	at $6\frac{1}{2}$*d.*	,,
,,	,,	30 ,, ,, 40 ,,	,,	,,	,,	at 7*d.*	,,
,,	,,	40 ,, ,, and over ,,	,,	,,	,,	at $7\frac{1}{2}$*d.*	,,

Note.—In the case of large trees, the tops below 6 in. q.g. are generally "thrown in," so that in respect of a tree of 30 to 40 feet the above prices are really increased by about $\frac{1}{2}$*d.* per foot if regard is had to the fact that the timber below 6 in. q.g. has been included.

These land rentals show the exact yearly return which will be obtained by growing the crop after paying back capital and interest on the £5 spent in planting, fencing, and cleaning the young crop.

It is imperative that all calculations as to the profits to be derived from forestry undertakings be made in this manner, for there is no other method which gives so clear and concise a financial statement which is at once intelligible to the lay mind. And if landowners and the corporations of our big cities and towns seek advice upon afforestation, it is earnestly to be hoped that such advice be always given in as clear and concise a manner as possible without simulation or dissimulation; let them know "the truth, the whole truth, and nothing but the truth," however unpalatable it may be.

The table on p. 192 discloses the exact financial result of growing Scots Pine calculated on the basis previously indicated.

I must admit that the above table is doleful reading—a loss of 2*s.* 8*d.* to 3*s.* 6*d.* per acre per annum, according to the length of the rotation, representing a capital loss per acre which is almost astounding, and this, too, even though the land can be obtained rent free; and it stands forth in mournful contrast to the happy results which many believe can be achieved, even with timber selling at the present price.

Of course, if the initial cost of planting, fencing, and establishing the young crop could be reduced on the average to (say) £3 10*s.* per acre, that would lessen the loss by about 1*s.* 2*d.* per annum; or if the annual outgoings per acre could be reduced below 3*s.* 6*d.* the results would be correspondingly better. However, in this connection it is well to remember

YIELD AND FINANCIAL RETURNS OF SCOTS PINE GROWN UPON AVERAGE SOIL. (AFTER SCHWAPPACH.)

For one Acre.

Years since planted with three-year-old treees.	THINNINGS REMOVED.				CROPS LEFT AFTER A THINNING.					PER CENT. INCREASE DURING LAST PERIOD.		YEARLY LAND RENTALS.	Equivalent accumulated capital sum representing net gain or loss per acre. Approximately.
	Cubic feet (quarter girth) cut (to 3 in. diameter).	Average per tree (cubic feet).	Value Felled		Trees left.	Cubic feet (quarter girth) left (to 3 in. top diameter).	Average per tree (cubic feet).	Value standing		Increase in volume of timber.	Increase in value (gross).	From date of planting, after deducting 3*s.* 6*d.* for annual outgoings, and paying back capital and interest on £5, the cost of planting, fencing, and establishing the crop.	
			At per foot.	£ s. d.				At per foot.	£ s. d.	Per cent.	Per cent.		
27	10	—	3*d.*	0 2 0	1,600	750	$\frac{1}{2}$	3*d.*	9 10 0	...	...	At $3\frac{1}{2}$ compound interest.	
37	90	$\frac{1}{5}$	3*d.*	1 0 0	1,100	1,310	$1\frac{1}{5}$	3*d.*	16 10 0	6	6		
47	220	$\frac{3}{4}$	3*d.*	3 0 0	760	1,850	$2\frac{1}{2}$	3*d.*	23 0 0	$4\frac{1}{2}$	$4\frac{1}{2}$	Loss of 3*s.* 0*d.* per annum	—
57	240	$1\frac{1}{4}$	3*d.*	3 0 0	560	2,270	4	$3\frac{1}{2}d.$	33 0 0	3	$4\frac{2}{5}$	,, 2*s.* 8*d.* ,,	£23 loss.
67	220	2	3*d.*	3 0 0	440	2,610	6	4*d.*	43 10 0	$2\frac{1}{5}$	$3\frac{3}{4}$	,, 2*s.* 9*d.* ,,	£35 loss.
77	220	$2\frac{3}{4}$	3*d.*	3 0 0	360	2,890	$8\frac{3}{4}$	$4\frac{1}{2}d.$	54 10 0	$1\frac{3}{4}$	$2\frac{3}{4}$	,, 3*s.* 0*d.* ,,	£56 loss.
87	...	...	Final crop of 360 trees ...			3,310	$9\frac{1}{4}$	$4\frac{1}{2}d.$	63 0 0	$1\frac{1}{3}$	$1\frac{1}{3}$	,, 3*s.* 6*d.* ,,	£95 loss.

NOTE.—The value of the thinnings when *felled* has been taken at the same price per foot as quoted for the *standing* timber. My reason for doing so is to avoid unnecessary detail, and to make some allowance for the fact that a small quantity of thinnings, scattered over an area, is not so readily saleable as is a final crop.

that in the recent report on afforestation issued by the Coast Erosion Commissioners, their estimate of the cost of planting up some millions of acres of waste land was £6 10*s*. per acre; and their estimated cost of average annual outgoings was 4*s*. per acre.

So, again, if a lower rate of interest than 3½ per cent. be taken, the losses will not be so great. But I have taken 3½ per cent. interest because it is approximately the rate of interest at present yielded by most "trustee stock," and it is approximately the lowest rate of interest at which the more wealthy of our cities and corporations can borrow money.

Now I must ask my readers to consider very carefully whether the yield of timber per acre, as instanced in the above table, is reasonable—for it is a German yield table—and whether the prices per foot at which I have valued the timber are correct for their respective localities. As to the former point, my own opinion is that, approximately, similar yields of timber may be looked for on fair average mountain land at an elevation of from 650 to 950 ft. above sea-level, provided always that there is higher land in the vicinity which will afford a certain amount of shelter and protection; provided also that in such a yield table no special allowance has been made for special damage wrought by insects, fungi, fire, or storm. My own yield table for Scots Pine grown upon second quality soil in this country shows far too high a yield for average land at an altitude of 650 to 950 ft. above sea-level.

It is interesting to compare the yield at the sixty-seventh year, viz., 2,830 cubic ft. (including thinnings), worth £46 10*s*., with the returns from a large typical area in Inverness-shire, which, along with others, I quoted in the January number (1910) of the *Quarterly Journal of Forestry*, Vol. IV., pp. 39, 40 (5). This was a typical, well-grown, mature Scots Pine area, sixty to seventy years old, situated at 600 to 1,000 ft. above sea-level; it contained 2,250 cubic ft. per acre; there was a railway station within a short distance; one block had been sold for £42, and another block for £45 10*s*. per acre.*

* There were only 250 trees per acre, averaging 9 cubic feet each, which realised 4½*d*. per foot. If there had been more trees per acre, as in the German table, the

Then, again, I direct especial attention to the two columns showing the percentage increase that takes place between each period when a thinning is made. It appears to me that it is a conclusive proof that we in this country must not be blindly led away by German methods of timber-growing. I am not attempting to argue that German foresters do not realise what is the best course to adopt in their own country, but I do assert that, in this country, landowners will suffer considerable losses if they plant land without duly weighing the results which are likely to accrue, or if they grow their timber upon rotations which are too long, or if they leave the trees too thick upon the ground when once the principal height-growth has been attained.

FRUIT BOTTLING: AN INDUSTRY FOR SMALL HOLDERS.

EDITH BRADLEY.

Of all the useful and valuable food products which a small holder can grow, fruit and vegetables should rank amongst the first; but, as fruit-growers know only too well, this branch of agriculture is a great lottery: in a good year the crop may bring in hundreds of pounds, in a bad year hundreds may be lost. Consequently, the utmost use should be made of all fruit which reaches maturity, and if it cannot be consumed or sold in its ripe state, it should be preserved for future requirements, during the seven or eight months of the year when our orchards are unproductive.

Of all forms of fruit preservation, there is none more simple or more satisfactory than Fruit Bottling. It is simplicity itself, only requiring the natural care of a trained intelligence, it is inexpensive, and it can be made a profitable industry.

The Process.—Fruit bottling preserves the fruit by de-

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average per tree would have been much less, and a lower price per foot would have been obtained, although perhaps slightly more timber per acre might have been grown, but the value per acre would have been about the same or possibly less.

stroying the germs which cause decay. If the germs are destroyed, the fruit or vegetable will keep sound and good for a considerable time if kept perfectly air-tight. Some samples of fruit which were bottled four years ago are still good. This result can be obtained by simply filling an air-tight jar with fruit, capping it, and subjecting the bottle, with its contents, to steam heat at a certain temperature.

The process is as follows:—

The fruit which is to be sterilised should be gathered on a dry day, carefully sorted, and, where possible, graded into different baskets or pans. It must always be remembered in selecting the fruit that bad fruit is bad fruit, and inferior fruit can never be made into choice fruit by any process of drying, bottling, or making into jam. Good fruit and its products always have a certain value, and the preserved article can always command a fair price.

All fruits require certain preliminary preparation before putting into bottles: for instance, gooseberries should be topped and tailed, currants shredded from their stalks with light fingers, rhubarb should be skinned and cut into pieces of a uniform size; cherries must be stalked, and, if possible, stoned; the hull should be removed from raspberries; plums, greengages, and damsons must have their stalks removed; large juicy plums should be cut into halves before being placed in the bottle; peaches and nectarines should be skinned, stoned, and halved; apples and pears must be peeled and cut into halves and quarters. A silver or plated knife only should be used for fruit.

When the fruit has been prepared, it is carefully packed into a wide-mouthed bottle with a proper cap; the more care that is taken in placing the fruit in the bottle the better is the result. Soft fruit, like gooseberries and currants, require shaking together in order to be packed closely; rhubarb should be placed in upright rows as far as possible; plums also should be arranged in rows, because the bottle will hold more if they are put in in this way. The taste and ingenuity of the fruit bottler has ample scope for display at this stage.

Having filled the bottle with fruit packed closely together,

plain cold water should be added, until the fruit is entirely covered. Next, the rubber ring, which helps to make the bottle air-tight, should be carefully laid, without twist or wrinkle, on the rim specially made for it, in the neck of the bottle; upon the ring should be placed the *glass* or *metal* disc, which can be held in position by the second finger of the left hand, while the metal ring is screwed on with the right hand, but is left slightly loose to allow for expansion.

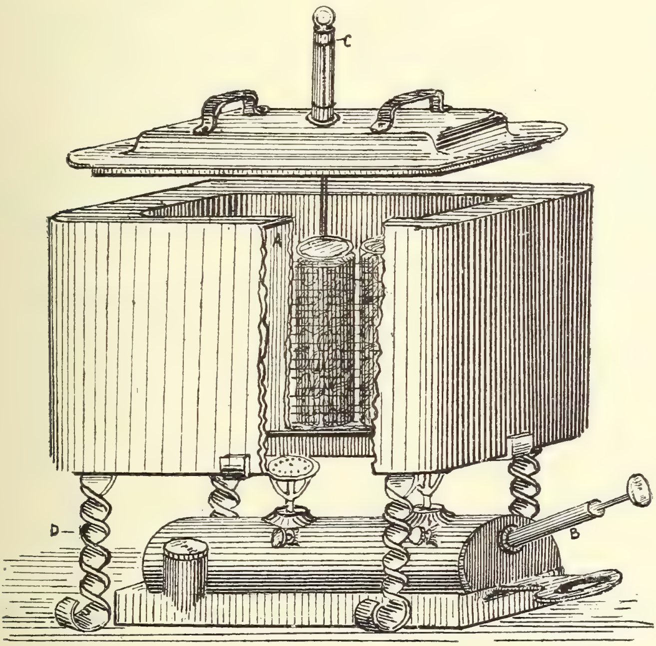
A dozen or fourteen bottles so filled constitute "a charge" for the Steriliser (see figure), in which they are placed in neat rows; cold water is poured into the vessel, until it reaches nearly to the shoulder of the bottles; the lid is put on, and the thermometer with the long bulb inserted through the opening made to receive it in the middle of the lid (*c*). The temperature should be carefully noted at this point; it is usually about 60 or 65 degrees. It is clearly indicated on the porcelain dial of the thermometer, which should stand out above the lid of the steriliser, as seen in the accompanying illustration. The distended tube containing the bulb of the thermometer calls for notice, because when it is placed in the middle of the bottles, where the process of sterilisation is going on, it registers the exact degree of heat upon the white dial.

Heat is next applied to raise the temperature of the contents of the steriliser. It can be applied by a gas ring, an oil stove, steam, or a kitchen fire, and the temperature of the water bath is thus slowly raised until it is sufficiently high *inside* the glass jars to kill the germs. The exact degree of heat required varies with the fruit to be sterilised, and cannot be stated with absolute exactness. It is largely a matter for experiment. Some fruits and most vegetables require sterilising successively two or three times to destroy effectively the different germs.

The temperature should only be allowed to rise quite slowly—not more than two degrees a minute; otherwise the skin of the fruit is made hard and the inner part not acted upon satisfactorily; or, if skinned, it is likely to burst.

The hot air or steam by which the bottles in the steriliser are now surrounded causes the water or juice *inside* the

bottles to get hot and expand, until it reaches the capsule or cover. The requisite temperature is maintained for some time at a given point until the process is complete (this can be determined to a nicety by the fixed thermometer), and the bottles are either lifted out and put into a cool place or else cold water is turned into the machine whilst the bottles are in it (the hot water being gradually reduced in temperature). With the decreasing temperature a vacuum is created, and, unless the caps or tops are imperfect or imperfectly adjusted,



A USEFUL FORM OF STERILISER FOR FRUIT-BOTTLING.

and so admit the air, the contents of the bottle will keep for a long period, because the germs have been destroyed. On the other hand, if from any cause the vacuum is destroyed by imperfect capping, the bacteria of fermentation will gain admittance, and will start working with alarming rapidity. In a few days the fruit will be spoilt. It therefore follows that each batch of bottled fruit should be examined with care for a day or two, and if any doubt is entertained as to its condition, it is better to re-sterilise without delay.

The following table of approximate temperatures may be useful:—

	Temperature.	Length of time to maintain the maximum temperature.
Gooseberries ...	140—150°	30—45 minutes, according to degree of ripeness.
Red Currants ...	140—150°	20—30 minutes, according to degree of ripeness.
Raspberries ...	140—150°	20 minutes.
Black Currants ...	150—160°	30—45 minutes. (These may be sterilised a second time.)
Plums	150—160° according to variety.	30—45 minutes.
Apricots	160—180°	45 minutes.
Peaches	160—170°	45 minutes.
Tomatoes ...	170—180°	30 minutes. (Sterilise twice.)

As before stated, the temperature can only be given approximately, as the quality of the fruit, the season, and a variety of causes must leave much to the common sense and intelligence of the worker.

The approximate cost of the necessary appliances for this work are as follows. For fuller details, reference should be made to "The Book of Fruit Bottling," published by John Lane, price 2*s.* 6*d.*

(A)	Cost of steriliser for work on a commercial scale to hold 14 bottles	3	3	0
	Two gross of bottles, glass top. These are recommended. At 50*s.* per gross	5	0	0
	Primus oil stove. (A gas ring is preferable.) ...		12	0
	Iron stand for steriliser		4	0
		£8	19	0
(B)	Cost of small steriliser for household use, to hold 10 bottles	1	5	0
	One gross of bottles, metal top	1	14	6
	Primus oil stove or gas ring		9	9
		£3	9	3

It will be admitted that an outlay of £3 10*s.*, or even £9, is not a large one, especially when the direct advantage of having good, wholesome fruit for use all the year round be taken into consideration. Nevertheless, the small holder is only too often hampered by want of capital for immediate necessaries, and to find additional money for "season" work, such as fruit bottling, is out of the question. This, therefore, is the opportunity for co-operation. In fruit-growing

districts, one moderate-sized factory could bottle many gross of fruit, and could deal with the surplus product of all the orchards in a district, and thus the fruit could be safely preserved for winter use, instead of being sold at a loss, rotting on the trees, or forming food for pigs.

Forestry in Hesse and some other German States.

The Ministry for Finance in Hesse has issued as an appendix to the State Budget for 1910 a publication which cannot fail to be of great interest to landowners and others in England who are interested in forestry. The article deals with the Development of Forestry in Hesse during the last ten years, and contains besides some interesting comparative tables for other German States. A careful study of these figures is to be recommended to foresters and owners of woods, for they show the results which are obtained in Germany, and the directions in which improvements are likely to be effected.

The total area under the control of the Forestry Department of Hesse was, in 1907, 453,440 acres, made up as follows:—Family property of the Grand Ducal House, 175,578 acres; State forest, 7,578 acres; State Domain forest, 36,111 acres; Communal forest, 234,173 acres; total 453,440 acres. In the same year the gross income from these forests was £579,198, of which the Family and State forests yielded £234,674; State domain, £58,001; Communal forests, £286,523.

In order to show the progress which has been made during the last ten years, details are given of the returns from the Grand Ducal forests. The present area of these forests is 175,577 acres, of which 11,683 acres have been acquired during the last ten years, while 1,904 acres were added during the period 1889-1899.

Returns from the Forests.—During the period 1889/90-1899/1900 the average yearly yield was 12,281,752 cubic feet, while during the second period of ten years (1899/1900-1909/1910) the average yield was 14,297,488 cubic feet. This indicates an increased yearly yield of 2,015,736 cubic feet, of which 488,355 cubic feet is due to the increased area of

wood and 1,510,250 cubic feet to improved forestry methods. More intensive methods of cultivation have increased the yield per year per acre from 74 cubic feet to 83 cubic feet. Whereas the yield in 1889-90 was 73 cubic feet, in 1908 it was 85 cubic feet. This is a substantial increase, and the reasons for the improvement are worthy of note.

In the first place the size of the forest range has been decreased so that the "Oberforster" has now a smaller area to supervise, and is therefore able to give more time to each separate wood under his charge. This has resulted not only in a larger return from thinnings, but also in an increased increment. During the period 1889/1890–1899/1900 50 per cent. of the total yield was obtained from thinnings and 50 per cent. from final fellings, whereas in the second period of ten years 62 per cent. was obtained from thinnings and 38 per cent. from final fellings. The result of the change has therefore been to increase the yield and to improve the state of the woods. In the second place a new method of working plan has been introduced. Under the old system the woods were divided into Age Classes and treated accordingly, while under the new system the treatment is based on the relation between the actual and the normal increment in a given wood. The fellings are then arranged so that within a reasonable period of time the increment of the forest may be raised to the normal.

It is held that the yield of the forests of Hesse can be further improved in three ways:—(1) By felling areas which are stocked with unsuitable species and replanting with others; (2) by filling up blanks in areas recently purchased; (3) by the conversion of oak coppice into high forest.

It is estimated also that the new method of treatment will have a considerable effect on the revenue by increasing the proportion of useful timber and decreasing the proportion of firewood in the yield. Timber on an average is worth twice as much per cubic foot as firewood, and in the last ten years the proportion of timber has been increased 6 per cent., viz., from 18 per cent. in 1889 to 24 per cent. in 1899, and 29 per cent. of the whole in 1908.

The Gross Yield.—In accordance with the increased yield in timber the gross annual income has also grown from

£144,248 in the first ten-year period to £197,582 in the second. This increase is due, also, in part to the increased prices obtained for wood, as is shown in the following table:—

Average for year.	Timber.	Firewood.	Average price for whole yield.
	d.	*d.*	*d.*
1895–96 & 1897–98	5·6 per cubic foot	2·1 per cubic foot	2·9 per cubic foot
1905–1907	5·9 ,, ,,	2·5 ,, ,,	3·4 ,, ,,

For the first ten-year period the gross annual income per acre was 17*s.* 4*d.*, and for the second 23*s.*

The costs of running the forests are grouped under four heads, viz., Cultural Expenses, Road-making, Conversion of the Crop, and Administration and Protection.

Cultural Expenses.—During the first decade the cultural expenses were practically constant at 11·5*d.* per acre per year, and during the second averaged 2*s.* 3·5*d.* per acre per year, with a tendency to sink a little during the last three years. There are several reasons for this increase. In the first place there has been a general rise in wages of about 33 per cent., consequent on the great industrial development and the abundance of work. The rise in wages accounts for 3·8*d.* per acre. A second reason is the change of management to a more intensive system of cultivation. Areas with low increment have been taken in hand and regenerated, artificially where necessary. A better system of fencing against game has been adopted, and nurseries have been enlarged and improved to yield the best possible supply of plants.

The re-afforestation of purchased areas accounts for 5*d.* per acre more of the increased cost. Of some 11,825 acres purchased during the second decade about 10,000 acres were private woodland in a poor condition. Most of this had to be replanted at a cost of £3 12*s.* per acre.

On the other hand the cost of regeneration of State forests is only £2 8*s.* per acre. From 1903-1907 6,500 acres of oak coppice were converted into high forest. This has added an additional 2·5*d.* per acre to the average cost for the whole.

Road-making.—The cost for this item has risen from 1*s.* 0·4*d.* per acre for the first ten-year period to 1*s.* 4*d.* for

the second. The increase is due to the increased rate of wage.

Cost of Conversion.—For the first decade the cost was 0·6*d.* per cubic foot, or 3*s.* 9*d.* per acre, and for the second 0·76*d.* per cubic foot, or 5*s.* 4*d.* per acre. The increase is chiefly due to higher wages, but also to the increased care taken of the men, the barking and conveying to depôts of coniferous timber. In this connection special attention is called to the value of forestry in providing winter employment for agricultural labourers.

Administration and Protection Expenses.—Since the introduction of the new working plans in 1897–8 administrative expenses have risen from 2*s.* 10*d.* to 3*s.* 5*d.* per acre. As previously stated, the new system brought about a reduction in the average size of the forest range. The average area of an "Oberförsterei" in Hesse is now 6,360 acres of forest. The best authorities consider that for intensive work the size of a compact range should not exceed 5,000 acres of wood. In this connection the table on page 203 is of interest. The average area under an academically-trained officer is shown, together with the administrative expenses and net income per acre for several States. As far as comparison is possible, owing to the varying conditions in the different States, it will be noticed that there is decidedly a general tendency for the net income to rise as the average areas under an academically-trained officer diminishes, and consequently as the administrative expenses increase. There is evidently a close relation between the intensity of culture and the profits to be obtained from forestry.

The Net Yield.—The net yield per acre has grown from 8*s.* 8*d.* in 1889-90 to 13*s.* 2*d.* per acre in 1908. It is worthy of remark that the forests are even now in a transition state, and an increased net yield may be expected. This raises the question as to the best method of increasing the net yield, and the conclusion is reached that this may be done, not by decreasing the costs, but by adopting a still more intensive system of cultivation.

Comparison between the Hessian and other German State Forests.—In the foregoing table the net yield for several States is given. Two factors come into play in determining the yield, viz., the quantity of timber cut per acre, and the

average price obtained per cubic foot. Both factors, apart from methods of treatment, climate, soil, and market conditions, depend on the ratio between the area under hardwoods and the area under conifers.

State.	Total area of Forest under working plan Acres.	Number of Forest Ranges.	Average area of a Forest Range. Acres.	Total number of academically trained officers.	Average area under academically trained Officer. Acres.	Total administrative expenses in 1907. Per acre.	Net income per acre in 1907 (for State Forest).
						s. d.	s. d.
Saxe-Weimar...	115,255 State Forest	33	3,493	64	1,801	3 4	19 0
Saxony ...	445,010 State Forest	109	4,083	208	2,139	5 1	24 5
Saxe-M. ...	110,379 Demesne Forest	24	4,599	35	3,154	2 5	24 1
Brunswick ...	210,730 State 48,363 Communal, &c. 259,093	44	5,868	72	3,599	3 11	13 1
Württemberg...	483,727 State 432,915 Corporate bodies 916,642	150	6,111	233	3,935	4 3	31 0
Bavaria ...	2,357,754 Imperial 964,552 Communal, &c. 3,322,306	381	8,719	840	3,954	2 7	11 0
Hesse	175,577 Grand Ducal 277,863 Various 453,440	86	5,273	114	3,977	3 5 *	12 8 *
Baden	234,203 State 596,826 Communal, &c. 49,489 Corporate bodies 880,518	102	8,633	180	4,891	3 0	22 5

* Refers to Grand Ducal Forests.

It is a well-known fact that conifers, especially spruce and silver fir, can be worked on a shorter rotation and give a greater annual increment with a greater percentage of useful timber than broad-leaf species. Spruce and silver fir show nearly double the increment of the common broad-leaf trees, and yield 90 per cent. of useful timber at a lower cost for conversion of the crop, whereas with oak the figure is 35 per cent., and with beech only 22 per cent. of the whole timber yield.

In the following table the percentages of forest area under conifers and under broad-leaf trees are shown, together with other relevant figures. From this it will be seen that the greater the proportional area under conifers (with the exception of Württemberg) the greater the proportion of useful timber, and the greater the average price per foot for the whole.

State.	Total yield per acre per year. Cubic feet.	Wood to 2·8 in. least diameter. Cub. ft. per acre.	Wood to 2·8 in. diameter.		Proportion of useful timber in		Price per foot.		
			Broad-leaf. Per cent.	Conifers. Per cent.	Wood to 2·8 in. diameter. Per cent.	Total felling. Per cent.	Timber.	Firewood.	For the whole.
							d.	*d.*	*d.*
Saxony ...	93·66	78·5	3	97	83	70	6·2	1·7	4·9
Württemberg...	107·53 *	90·2	26	74	63	55	—	—	5·1
Baden... ...	92·2	76·4	33	67	48	43	7·09	2·99	4·6
Bavaria ...	67·5	58·3	—	—	52	45	5·9	2·14	3·9
Hesse ...	87·1	64·35	59	41	40	30	5·8	2·54	3·5

* Includes an emergency felling of 5,250,000 cubic feet for the formation of a reserve fund. The yield for ordinary years is 94 cubic feet per acre.

The article contains also a note on the future timber supply of the world. From data which have been published by Prof. Sir W. Schlich in England, the conclusion is reached that there is every indication of a serious shortage in the near future, and that it behoves the forest authorities of Hesse to conserve and increase in every way possible the supply of a raw material which is so essential to modern industries.

For the landowner who wishes to improve his woods, some useful inferences may be drawn from this report. The outstanding point is that it pays to spend money liberally on the forest in certain directions. One of these ways is in providing proper supervision. It is not uncommon in England to find a couple of thousand acres under the charge of a working forester, uncontrolled even by a working plan, and responsible to a land agent who in many cases has no special knowledge of forestry beyond the most elementary first principles. In this connection the area under each academically trained officer in German forests (see table, p. 203) is of interest. The table takes no account of forest guards, who are at least three times as numerous as the superior officers, and have quite the equivalent in knowledge that our working foresters possess.

The term "intensive cultivation" as used above implies not only close supervision of the existing forest, but careful planting of each soil with the most suitable species. In the shallow valleys of the Odinwald, for example, the

bottoms are planted with oak, ash, and so on, while the sides are stocked with suitable conifers, and owing to rapid changes of soil it is often impossible to plant a single species over greater extents than half an acre.

The charge of 1*s*. 4*d*. per acre for roads is also a noticeable item. On the same scale an estate of 2,000 acres of woodland should be prepared to spend over £130 per year in maintaining, re-grading, and metalling its roads, and in laying out fresh lines of communication.

Attention may also be directed to the average prices obtained for timber. The highest average price is 7·1*d*. in Baden, and the lowest 5·8*d*. in Hesse, while firewood brings roughly from 2*d*. to 3*d*. per cubic foot. These prices are probably not as high as the average for English timber, although the quality is better.

The reason that German State forests yield from 11*s*. to 31*s*. per acre net is to be attributed not to superior soil and climatic conditions, but to the fact that timber-growing is a scientific undertaking, in which careful attention to detail meets with the same success that it does in any other business.

Reclamation of Moorland on the Continent.*

The extensive areas of moor and heath lands which exist in many parts of the Continent have naturally caused more attention to be devoted to the subject of their reclamation than has been the case in this country, and, owing in part to the fact that much of this moorland was State property, the Governments of several countries, particularly Prussia, Bavaria, Austria, Sweden, and Denmark, have taken active steps to encourage experimental and scientific work with a view to ascertain the best means of increasing the value of this land for agricultural purposes.

Prussia.—In Germany † the movement may be said to date from 1862, when Herr Rimpau introduced his system of cultivating peat land by the use of a surface covering of sand. The extraordinary success which he obtained directed general

* Some information as to the methods of reclamation adopted will be found in a previous article, "Utilisation of Peat Land on the Continent," *Journal*, June, 1907, p. 148, and in Leaflet No. 203.

† See *Die Entwickelung der Moorkultur*, Berlin, 1908.

attention to the subject, but the method was found to be only applicable to certain soils and places. In the next decade, the need for dealing with some extensive moors in Hanover led to official action being taken, and the Central Moor Commission was formed in 1876 to act as technical adviser to the Agricultural Ministry. In the following year, at the request of the Commission, the Experimental Station at Bremen was established in order to work out the manifold theoretical and practical problems connected with the rational cultivation of moorland. The funds placed at the disposal of the station were at first only £500 per annum, but they have been gradually increased until they amounted to over £5,000 in 1907. The influence of this station has been very great; at its first establishment the small staff had very little previous experience at their disposal, and they had before them the solution of such questions as the best methods of drainage and of cultivation, the choice of manures and of suitable varieties of plants, as well as the investigation of the chemical and physical properties and botanical characteristics of these moorland soils. Rapid progress was made, and in 1884 a sub-station was established at Ems, and another in 1905 at Aurich, together with several experimental farms and fields on different types of moor, heath, and marsh land. From the commencement an endeavour was made to enlist the sympathies of agriculturists by bringing the knowledge of improved methods to their notice by means of demonstration fields. These efforts proved very successful, and the fields now number several hundreds. A further step in this direction was the establishment of model farms under the direction of the station.

Apart from the expenses of the Central Moor Commission, the grants made by the Prussian Government for the encouragement of moor cultivation amounted in 1907 to £9,500, and the Government have also undertaken the reclamation of large areas of State lands. In the case of the Forestry Administration, some 15,000 acres have thus been dealt with and converted into good grazing land; at first the system of sanding the surface was adopted at a cost of about £11 per acre; subsequently the less expensive method of draining, cultivating, and applying artificial manures was employed,

and the cost reduced to £4 10*s*. per acre. The results have been very satisfactory both financially and as a means of instructing neighbouring farmers. The cost of cultivation and manuring is from 15*s*. to 17*s*. 6*d*. per acre per annum, and the value of the crop, varying according to the season, is approximately double as much. The interest on the capital outlay in 1904–6 was about 9 per cent. on the sanded area, and 19 per cent. on the remainder—owing to the smaller initial expenditure.

Bavaria.—The area of moorland in Bavaria is returned at 360,000 acres, and the State have for many years taken active measures to encourage its proper cultivation. A staff of engineers is maintained to give free advice and direct assistance in connection with all proposals for drainage and the improvement of the land. In 1900 a Central Institute was established at Munich to assist and advise owners as to the best means of cultivating their moorland properties. It has four experimental stations and four sub-stations in different parts of the country, and its total expenditure in 1907 amounted to £8,200, of which about £5,800 came from State sources. A Moor Culture Commission has also been appointed by the Ministry of the Interior.

Austria.—Experiments in the manuring of moorland were carried out by the Agricultural Experimental Station in Vienna at the beginning of the 'seventies, and this work was gradually extended until in 1904 a special section of the station with an experimental farm was established to deal with the subject. This farm covers about 55 acres, and comprises an experimental area of 5 acres, whilst the remainder is managed on practical lines as a model holding.

Experimental or demonstration fields varying in size from 2½ to 10 acres are arranged in different parts of the country by making a grant to some intelligent farmer and supplying him with seed and manures, and in special cases even implements, free, the farmer for his part undertaking to manage the field according to the instructions of the station and to provide the necessary labour.

Many of the Austrian moors are partly owned in common or are in the hands of numerous small owners, in a way which renders any general improvement difficult. The

establishment of a demonstration field is in such cases often supported by lectures and excursions to improved holdings, in order to convince the farmers of the advantages of the methods proposed, and to enable action to be taken in common for the improvement of the moor.

The utilisation of peat either for burning or for the manufacture of peat moss litter is another matter which receives great encouragement from the State.

Societies for the Promotion of Moor Cultivation.—There are two important societies for this purpose in Germany and Austria. The German society was established in 1883, and at the beginning of 1908 had 944 members. It has exercised a very important influence both in Germany and elsewhere, and receives a sum of about £950 annually from State and provincial funds. It publishes a fortnightly Bulletin, assists its members to buy manures, arranges experiments, and generally acts as a centre for the encouragement of the cultivation of moor, heath, and bog land in Germany. In 1904 it held an exhibition in Berlin, where everything connected with the subject was displayed, such as implements, manures, and industrial products. Specimen crops were also shown, with samples of the soils on which they were grown.

The Austrian society dates from 1900. It publishes a monthly magazine (*Die Osterreichische Moorzeitschrift*), holds an annual course of instruction lasting about a week, has a museum of specimens, gives advice, and otherwise endeavours to promote interest in the subject.

Denmark.—The efforts of the societies and experimental stations in Germany and Austria, which have been referred to above, have been chiefly, though not entirely, directed to the reclamation of moorland for agricultural purposes, either as pasture land or for the cultivation of crops. In Denmark, on the other hand, a good deal of attention has also been given to planting this land with forest trees.

The Danish Heath Society * was formed in 1866 to encourage the cultivation of the heaths of Denmark, and it acts as the medium through which considerable sums of public money are administered. The measures adopted by the

* *Journal of Irish Dept. of Agric. and Tech. Instr.*, April, 1909.

Society are the cultivation of heaths where possible, afforestation where the land is poor, drainage of marshes and irrigation of dry meadows, supply of marl and lime, distribution of young trees, and the creation of shelter belts. The subscription to the Society is 4*s*. 6*d*., and the number of members in 1907–8 was 4,657.

The total number of plantations under the direction of the Society is 1,790, covering about 159,000 acres. Since 1885 the cost of planting has been partly borne by the State, subject to a declaration by the owner of the woods that they shall be kept as enclosed forest by himself and his successors. The grant amounts to one-third of the expenditure on young trees, implements, fences, roads, clearing, and drainage. One-half of the grant is withheld until 13½ acres have been planted in one piece, and one-tenth until the plantation is complete. Many farmers have planted part of their land with timber, so that there are now many small woods, which are of great importance on account of the shelter they afford. In the case of certain types of plantation, the State grant amounts to one-half of the cost of the trees planted.

Another form of assistance is by means of the "Small Plantation Societies," which receive grants from the State. The officials of the Heath Society see that the money is properly applied, and also give advice with regard to the management of small woods. The State grant for this purpose in 1907 was £4,400, and the Society also distributed at half-price over fifteen million young trees.

The distribution of marl and lime is another part of the activities of the Society for which it receives a grant, and it has also carried out important drainage and irrigation works, particularly in Jutland.

It was not until 1888 that the reclamation and cultivation of moor or bog land occupied an important position in the Society's work, but since that time the promotion of a knowledge of the best methods of their cultivation has been one of its definite objects.

The system adopted has been the establishment of demonstration fields about 2½ acres in extent, and situated in some easily accessible spot. The labour is provided by the owner of the land, while the Society supplies artificial manures for

three to five years, and also seed. An annual inspection of the land is held, to which everyone in the neighbourhood is invited. The knowledge of the subject is now so general that these plots are considered to have served their purpose. In addition to 500 demonstration fields, the Society owns three experimental farms of 168, 841, and 173 acres respectively, for which the State makes a small annual grant.

Plans are prepared for drainage works and advice given as to the best method of cultivation. The greatest difficulty in this connection arises from the fact that a large number of owners are usually interested, and numerous meetings have to be held in order to obtain their consent.

Sweden.—The improvement of moorland by drainage and similar projects has received the attention of the State in Sweden for many years through a staff of engineers, who draw up plans and give advice in connection with such undertakings. In the ten years 1889–99, nearly 900,000 acres were dealt with in this way. The State also lends money and contributes towards the cost in certain cases.

The most important step in recent years towards the rational cultivation of this type of land was taken in 1886, when the Swedish Moor Cultivation Society was formed. This Society aimed more especially at the distribution of information and the inculcation of better systems of cultivation; experiments and research have, however, formed an important part of its programme.

The number of members is approximately 3,400. The subscription is 4*s.* 6*d.* per annum, and all the members receive a bulletin, which is published every two months, dealing with the work of the Society, and also of similar Societies abroad. In addition to the subscriptions, the Society receives a grant of £1,100 from the State and £800 from the Provincial Government and the Chamber of Agriculture. It has chemical and botanical laboratories at Jönköping, with an experimental garden, a library, and a museum. At Flahult, some seven miles distant, the Society has an experimental farm, where field experiments are carried out. Another large experimental area on a different type of soil was purchased in 1906.

Analyses of peat soils are made for members in the chemical

laboratory at a charge of 3*s*. 6*d*. each, and advice is given as to the best method of cultivation, manuring, &c. The Society also retains the services of a botanist, who makes a special study of the botanical questions connected with peat land. Each summer he visits and reports on the character of the peat and bog in a different district, and advises as to the methods of reclamation which he considers applicable. He also examines samples and advises members as to their suitability for fuel or litter.

Experimental cultivation is carried out on a large scale at Flahult, where the work is seen and examined by numerous visitors. The Society also encourages the formation of experimental fields on farms in different districts by supplying seeds and manures gratuitously. Demonstration plots have also been established with a view to educating the rural population. Practical advice and assistance in dealing with peat land can be obtained from an expert attached to the Society, at a small charge per day for maintenance, and this is a privilege which is much sought after. Illustrated lectures are given, and short courses of instruction for agricultural teachers are held.

The Royal Swedish Agricultural Academy at Stockholm also carries out manurial experiments on peat land, soil analyses, and investigations at various other experimental stations, supported by demonstration fields.

Shot-hole Fungus.
(*Cercospora circumscissa* Sacc.)

This parasite attacks the leaves of the peach, almond, cherry, apricot and nectarine. Less frequently the leaves of the plum and of other rosaceous trees are injured.

Appearance of the Disease.—The first indication of the disease is the presence of small pale-green, translucent spots scattered over the blade of the leaf. These spots gradually become more clearly defined, and increase in size up to a diameter rarely exceeding one-sixth of an inch. When the patches commence to turn yellow, the fungus

bursts through the epidermis of both sides of the leaf, in the form of very minute dark-coloured, hair-like tufts or threads which bear the minute spores at their tips. At this stage the diseased patches become dry and brown and drop out, leaving circular holes, suggesting the idea of the leaf having been riddled with small shot; hence the popular name of "shot-hole fungus" (*see illustration*).

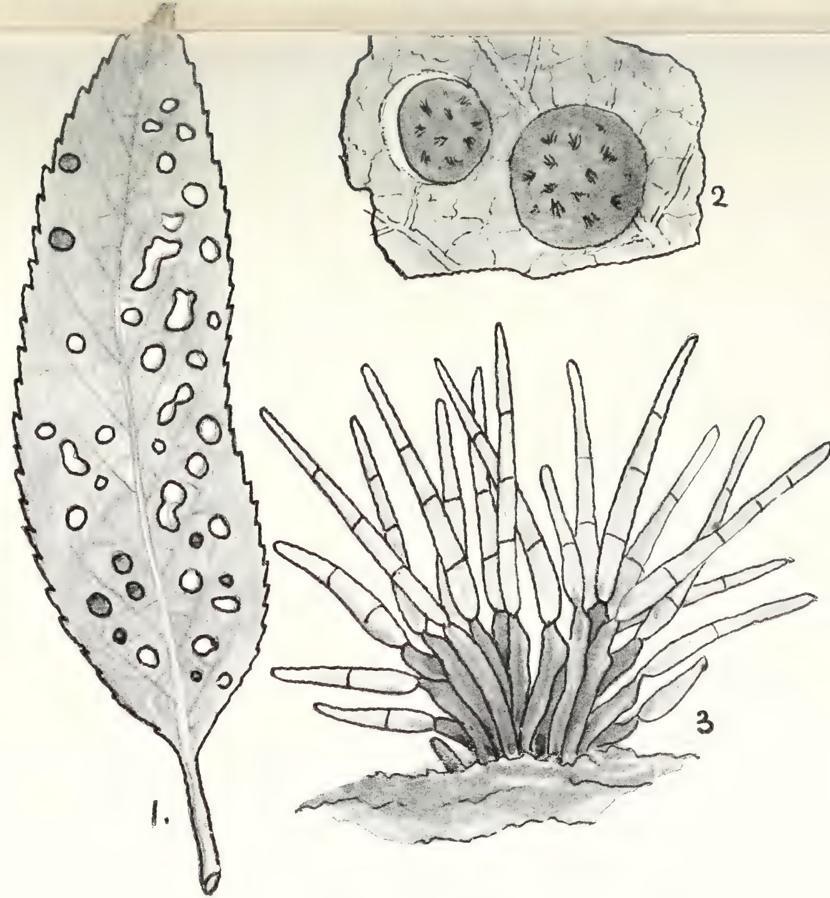
The reason why the pieces drop out of the leaf is as follows:—The irritation caused by the fungus induces the formation of a circumscribing wall of wound-cork or periderm round the affected area, cutting off its supply of food; the isolated patch therefore dies, contracts and falls out, carrying along with it the fungus, which remains in the fallen patches until the following season, when a crop of spores is produced and infection of the young leaves takes place. When the diseased patches have fallen the remainder of an injured leaf is quite green and appears to be perfectly healthy; nevertheless, such injured leaves invariably fall quite early in the season. As a rule when the disease once attacks a tree, owing to the rapid production of spores almost every leaf becomes infected, and it is not unusual for a tree to be completely defoliated early in the season. In such cases the formation of wood is checked, and there is a lack of reserve food which materially affects the succeeding crop of fruit. When nursery stock is attacked to the extent of causing defoliation for two or three seasons in succession, the trees never completely recover.

Remedies.—Peach foliage suffers most from the "shot-hole" disease in this country. In this case the disease is difficult to check, as, on account of the very tender nature of the leaves, Bordeaux mixture cannot be applied.

Dr. W. M. Scott, of the U.S. Dept. Agric., has found that a fungicide, known as "self-boiled lime-sulphur mixture," can be used on peach foliage without injury. The proportions for a mixture ready for use are:—8 lb. lime, 8 lb. sulphur, 50 gallons of water. The following is the method of preparation:—

"The mixture can best be prepared in rather large quantities—say 20 pounds, or even 40 pounds, at a time—so as to get enough heat to produce a violent boiling for a few

Cauliflower Disease of Strawberries.
(*Aphelenchus fragariæ*).



Shot-hole Fungus (*Cercospora circumscissa*, Sacc.).

1.—Diseased peach leaf (*nat. size*).
2.—Diseased patches bearing the fungus (*mag.*).
3.—Fruit of fungus (*highly mag.*).

minutes. Place the lime in a barrel and pour on enough water (about 3 gallons to 20 pounds) to start it slaking and to keep the sulphur off the bottom of the barrel. Then add the sulphur, which should first be worked through a sieve to break up the lumps, and finally enough water to slake the lime into a paste. Considerable stirring is necessary to prevent caking on the bottom. After the violent boiling which accompanies the slaking of the lime is over, the mixture should be diluted ready for spraying, and at least enough cold water added to stop the cooking. Five to fifteen minutes are required for the process, according to whether the lime is quick-acting or sluggish. The intense heat seems to break up the particles of sulphur into about the physical condition of precipitated sulphur, and the violent boiling makes a good mechanical mixture of the lime and sulphur. Only a small percentage of the sulphur—enough to improve the adhesiveness of the mixture—goes into solution, but if the hot mass is allowed to stand as a thick paste the sulphur continues to unite with the lime, and at the end of thirty or forty minutes enough of the reddish liquid is produced to burn peach foliage, and even apple foliage in some cases. Hence the necessity for cooling the mixture as soon as the lime is well slaked. The finely divided sulphur in mechanical mixture with the lime is depended upon for the fungicidal action rather than the sulphides in solution, the latter being harmful to foliage except in very dilute form.

"The mixture should be strained through a sieve of 20 meshes to the inch in order to remove the coarse particles of lime, but all the sulphur should be worked through the strainer.

"The amount of water required to make the best mixture depends largely upon the lime. Some grades of lime respond quickly and take a large quantity of water, while others heat slowly and are easily "drowned" if too much water is added at once. Hot water may be used to good advantage in preparing the mixture with sluggish lime, but with quick-acting lime hot water is not necessary, and is likely to bring too much of the sulphur into solution. If desired, the mixture may be kept for a week or more without deterioration, but should be thoroughly stirred before using.

"In applying the self-boiled lime-sulphur mixture, the spraying outfit should be equipped with a good agitator. The mixture settles to the bottom of the tank, and unless kept thoroughly agitated cannot be evenly applied."

Spraying should be commenced early in the season, when the foliage is about half-grown, and repeated as necessity demands.

If the soil be dug over during the winter, material capable of infecting the foliage in the spring would be buried.

Cauliflower Disease of Strawberries.

This disease was first observed by Miss Ormerod in strawberry plants received from St. Paul's Cray, Kent, in 1890. It was stated that in a field of fourteen acres, nearly half the plants were diseased. Specimens were submitted to Dr. Ritzema Bos, who confirmed Miss Ormerod's supposition that the injury was caused by an eel-worm, which proved to be an undescribed species, and was named *Aphelenchus fragariæ*.

The disease is readily recognised owing to the very remarkable malformations of growth. The flower-buds and flower-stems are stunted in growth, and form short, fleshy, irregular masses resembling pieces of cauliflower; hence the name "Cauliflower disease," suggested by Miss Ormerod. The buds in the axils of the leaves become hard and scaly, and do not grow out into stolons. In some diseased plants recently received at Kew, it was observed that the leaves were constantly small in size and much puckered and wrinkled. The eel-worms are present in considerable numbers in the diseased flower-buds and swollen portions of the plant (*see illustration*).

As a rule, single plants scattered at intervals throughout the field first show the disease, and if such plants are not promptly removed the disease gradually spreads to neighbouring plants, until the diseased patches become quite conspicuous owing to the stunted appearance of the plants and the absence of bloom.

Diseased plants should be removed and burned as soon as the disease is observed. Sulphate of potash has proved effective in checking the disease, applied at the rate of 1 cwt. per acre.

Notes on Insect and Fungus Pests.

Pear Thrips.—Towards the end of April a correspondent in the parish of Uppington, near Wellington, Salop, sent for examination a small quantity of damaged pear blossom, with several insects suspected of causing the injury. The insects included two Tortrix caterpillars, the male of the Pear Midge, and one specimen of the tiny beetle, *Meligethes aeneus*. In addition to these, however, at least twenty specimens of Pear Thrips were found, to which undoubtedly the greater part of the injury may be assigned. So far as the Board have any records, this is the first case of Pear Thrips found causing injury in England, though two similar cases have been noted by Carpenter in Ireland, and the pest has been recorded as injurious in America. As a remedy against this insect tobacco as a spray might be employed, though it is not certain that the liquid would reach the thrips in the blossom. Theobald and Pickering recommend 3 lb. of tobacco powder to 10 galls. of water. It is probable that this would also act as a deterrent to the midge, and, at any rate, the blossom would not be injured.

Damage to Clover by Eel-worm and Clover Midge.—A correspondent at Roxford, Hertingfordbury, Herts, forwarded a small parcel of clover roots, badly infested with eel-worm. The maggots of a clover midge, *Cecidomyia trifolii,* were also present in large numbers, and in general the plants were so seriously attacked that the only course that could be advised was the destruction of the crop.

Currant Black-Knot.—A remarkably bad attack of Currant Black-Knot (*Plowrightia ribesia,* Sacc.) was reported in a garden near Cambridge, and a further attack soon afterwards was declared at Swavesey in the same county. It was also discovered in a garden in Middlesex. The trees in the first case were very seriously attacked, and about one-third had already died. Of the remainder about three-quarters were obviously affected. Cases of this disease appear to be more common than was originally supposed, though fortunately there is at present no sign of an epidemic. The disease is described in Leaflet 213.

Corky Scab.—Several further cases of Corky Scab (*Spongo-*

spora scabies) have been reported. In one case a grower at Wellingborough submitted for inspection seed brought from Scotland. A second case came from Clayton-le-Moors, Lancs. The owner stated that the land had borne potatoes for six years in succession, but the last harvest was a complete failure. The third came from Silkstone, near Barnsley. In each case the owner reported the case as one of wart disease, the appearance of the potatoes sent being not unlike potatoes slightly affected with that disease.

Blackleg and "Sprain."—One serious case of Blackleg (Leaflet 117) was reported from Wetherby, and one case of Sprain from an allotment in Daventry.

Various Fungus Attacks.—One case of Apple Mildew was reported on April 22nd from a garden near Debenham, Suffolk. Other fungus attacks were reported as follows:—Eucharis lily at Marple Bridge, Stockport, covered by the non-parasitic myxogastric *Spumaria alba* D C. This can be removed by applying a jet of water. Lobelia seedlings in the People's Park, Halifax, covered with a form of the non-parasitic *Aldrigea gelatinosa* Mass. The seedlings were uninjured. Watering with a dilute solution of nitrate of soda should prove useful. Douglas fir seedlings near Berkhampstead, imported from Germany in the autumn of 1908, were covered with a fungus which resembled the description of *Dothiorella pithya* Sacc. The bark was destroyed at the ground level. *Puccinia vincae,* the fungus that injures periwinkle, was reported from Midhurst.

Cucumber and Tomato Canker.—In the issue of this *Journal* for October, 1909, the first appearance of a disease of cucumbers and tomatoes, that has proved destructive in America, was recorded at Waltham Cross and in Gloucestershire. Leaflet 230 (Cucumber and Tomato Canker) was subsequently published, dealing with the disease. Since then a fresh outbreak has been discovered at Kenilworth, where no less than four growers were found to have their plants attacked, one of whom at least was found to have had the disease last year. Both the seedlings and the six-inch high plants were affected, though some of the growers had the disease in one set of plants and some in the other. It is exceedingly likely that this disease has appeared in other

FIG. 14.—HORN-OF-PLENTY

(*Craterellus cornucopioides*).

FIG. 15.—GIANT PUFFBALL

(*Lycoperdon giganteum*).

places, and growers would be well advised to examine their plants carefully, and to send specimens of suspicious cases to the Board for determination. The disease has spread in the district round Waltham Cross, where it first appeared, and has been reported from Guernsey. In the latter case the bigger plants were more seriously attacked than the seedlings.

EDIBLE FUNGI.*

HORN-OF-PLENTY, *Craterellus cornucopioides* (Fig. 14).

A peculiar-looking fungus, resembling a long, narrow funnel, having the edge turned back and more or less wavy, substance thin and pliant; inside dark brown, often with olive shades, minutely scaly, outside dull lead-colour, with scattered pits or depressions, slightly wrinkled; stem hollow, smooth, blackish.

It commonly grows in tufts on the ground in woods during autumn. Some specimens attain a height of four or five inches, but it is usually shorter.

This variety is not usually recognised as an edible fungus, but it is considered to be amongst the best by those who know it.

GREAT PUFFBALL, *Lycoperdon giganteum* (Fig. 15).

This fungus cannot be mistaken for any other species, on account of its large size and persistently pale colour. In form it is nearly globose, puckered into a short rooting portion. At first it is pure white in colour and sometimes remains so, but it usually becomes tinged yellow when old. Size from 5 to 9 inches in diameter. The flesh is at first pure white and compact, slowly changing to primrose-yellow, and finally becoming resolved into a dry powdery mass of spores.

It grows in meadows, borders of fields, &c. It is only good for food so long as the flesh remains perfectly white. For cooking, the puffball should be peeled, the flesh cut into slices about half an inch thick, prepared with egg and bread-crumbs, and fried in butter.

* The previous numbers of this series of coloured plates and descriptions have appeared in the *Journal* as follows :—Nos. 1–3, February, 1910 ; Nos. 4–6, March, 1910 ; No. 7, February, 1909 ; Nos. 8–10, April, 1910 ; Nos. 11–13, May, 1910.

EDIBLE BOLETUS, *Boletus edulis* (Fig. 16).

A large fungus differing from the mushroom in not having gills on the under surface of the cap, but a compact mass of slender tubes arranged side by side, the surface of which looks as if it was crowded with pin-holes. The cap has aptly been described as resembling a penny bun in size and colour, 4 to 6 inches across; flesh white, not changing colour when broken; tubes greenish-yellow when old. Stem stout, three or four inches long.

It is found on the ground in woods during late summer and autumn.

The tubes should be removed, as they impart a somewhat viscid consistency to the dish.

Conservation of Natural Resources in the United States.

Great interest has lately been aroused in the United States in the subject of the waste of the natural resources of the country. A Commission * appointed by President Roosevelt to inquire into the conditions of country life stated that wastage of soil resources through poor farming was a general feature of American agriculture, a decline in fertility being marked in every part of the United States, even in the richest lands of the prairies.

A Conference of the Governors of the United States was held at Washington in May, 1908, and another Conference met at Washington in February, 1909, to which delegates were sent by the United States, Canada, Newfoundland, and Mexico.

This Conference recognised as the natural resources which they had under consideration "all materials available for the use of man as means of life and welfare," such as (1) land, that is the soil available for the production of crops; (2) forests; (3) water, whether for domestic use, irrigation, navigation, or power; and (4) minerals. They agreed that those resources which are necessaries of life should be regarded as public utilities, that their ownership entails specific duties to the public, and that as far as possible effec-

* *Journal*, May, 1909, p. 132.

FIG. 16.—EDIBLE BOLETUS

(*Boletus edulis*).

tive measures should be adopted to guard against monopoly. With this view they made a number of suggestions in general terms, and finally passed a resolution to the effect that the Conference "is convinced of the importance of the movement for the conservation of natural resources on the continent of North America, and believe that it is of such a nature and of such general importance that it should become world-wide in its scope, and therefore suggests to the President of the United States that all nations should be invited to join together in conference on the subject of world resources and their inventory, conservation, and wise utilisation."

The suggested Conference has not yet been summoned, but legislation is now being advocated in the United States with a view to secure for the benefit of the community the rights of the State in the minerals and water of public lands, and also to provide for the development of forests, unproductive land, and inland navigation. A Special Message from President Taft to Congress on January 14th outlines the action necessary in the following directions:—(1) The retention under Government control of minerals and water-power on public land (which includes an area of over 700,000,000 acres, chiefly mountain ranges and arid and semi-arid plains); in the case of water-power, the object of the proposed control is to prevent any monopoly under private ownership; (2) conservation and improvement of the soil by draining, rotation of crops, &c.; (3) irrigation of arid lands; (4) a scientific method of working the public forests; and (5) the improvement of inland waterways.

Of these, the conservation of the soil of the country is regarded as in many ways the most important, although it cannot be made the subject of legislation. It is pointed out that it is incumbent upon the Government to foster by all available means the resources of the country that produce the food of the people. The means suggested appear to a great extent to consist of the distribution of information and advice through the Department of Agriculture on subjects such as drainage, rotations, suitable crops, and other matters relating to the improvement of agricultural methods. In regard to the drainage of marsh lands and the irrigation of arid lands, further direct action is advocated.

The forest reserves of the United States, some 190 millions of acres in extent, are under the control of the Department of Agriculture, which is said to possess adequate authority for their preservation and extension, but the control of private owners in their treatment of the forests which they own is not a matter within the jurisdiction of the Federal Government. It is suggested that money should be allotted each year to enable the Government to undertake reafforestation at the sources of certain navigable streams.

Report of the Commercial Control Branch.

Part I. of the Report of the Intelligence Division of the Board of Agriculture and Fisheries has recently been issued [Cd. 5172, price 5½*d.*]. In this Report the Assistant Secretary (Mr. T. H. Middleton) describes the work dealt with in the Commercial Control Branch during the year ended December 31st, 1909.

This Branch undertakes inquiries and correspondence as to the administration of the Sale of Food and Drugs Acts, 1875 to 1907; complaints relating to adulteration of articles of food affecting the interests of agriculture; the administration of the Fertilisers and Feeding Stuffs Act, 1906; prosecutions under the Merchandise Marks Acts, 1887 to 1894; and complaints as to rates and facilities for the carriage of agricultural produce by rail.

As will be gathered from the above statement, the work of this Branch is of direct assistance to the farmer in preventing the adulteration or misdescription of articles which might cause him to be exposed to unfair competition in regard to some of his produce, in securing the genuineness of the fertilisers and feeding stuffs which he buys, and in making representations to the railway companies in regard to well-founded complaints as to rates and facilities for the carriage of produce by rail.

The Report in question describes the numerous cases investigated during the year under the Food and Drugs Acts in regard to the adulteration of milk and cream, butter, cheese, and cider, and under the Merchandise Marks Acts in regard

to cases of false description. For instance, the attention of the Board was called to the practice which prevailed in Manchester of applying false trade descriptions to foreign poultry. One of the Board's Inspectors, in conjunction with a farmer resident in the neighbourhood of Manchester, visited the market and purchased a goose to which a label was attached bearing the words "Prime Fat Cheshire Geese," and a turkey to which a label was attached bearing the words "Fine Fed Norfolk Turkeys." These birds were pronounced by expert poulterers to be foreign, and proceedings were instituted, as a result of which the seller was fined £10 and costs.

In another case, the Board instituted proceedings against a trader in Cheshire for selling eggs to which a false trade description had been applied. The evidence showed that a box of eggs, with a card near it displaying the words "Finest Irish Eggs, 12 for a shilling," in conspicuous lettering, had been placed in a prominent position on the floor of the defendant's shop, and that the eggs were, in fact, of foreign origin. A fine of £1 1*s*. with £3 3*s*. costs was imposed.

In referring to questions of railway rates and facilities, reference is made to the Board of Trade Conference, on which the Board of Agriculture were represented. Two subjects of special interest to agriculturists were dealt with at the Conference, (1) the machinery for settling disputes between companies and traders, and (2) owners' risk rates. In regard to the latter, the Board have issued a Leaflet No. 110 detailing the amendments which were agreed to.

Complaints were made to the Board with regard to a notice given by some of the Scottish Railway Companies as to the conditions on which waggons would be supplied. A Conference was held by the Board of Trade between representatives of the Scottish Railway Companies and Scottish traders, at which the Board of Agriculture and Fisheries were represented. The Conference resulted in a modification of the condition in question, and no further complaints were received on this subject.

A number of individual cases in regard to railway rates were investigated, and also some miscellaneous inquiries, including nineteen cases of alleged poisoning of farm stock by feeding stuffs. Inquiry was made into each case, and

fifteen samples of feeding stuffs were analysed. In four samples of bean meal, prussic acid was found to be present, but in three of these cases it was not possible to obtain a sample of the beans from which the meal was made; in the fourth the sample of beans was a mixed sample, composed partly of Burma beans which contained 0·029 per cent. of prussic acid.

Rules for Co-operative Milk Depôts and the Supply of Sanitary Milk.

The recent article in this *Journal* (January, 1910, p. 810) on the Organisation of the Milk Supply, dealt with the co-operative sale of milk, and several instances were quoted where the principle had been successfully adopted. Several of these instances were in Scotland, where, as mentioned above, under the guidance of the Scottish Agricultural Organisation Society, the formation of milk depôts for the collection and treatment of milk from the surrounding districts has been successfully adopted.

For the purpose of guiding the committees and managers of dairy associations of this type, the Scottish Agricultural Organisation Society have drawn up very carefully considered rules, and the Board think it may be useful to reproduce them in this *Journal* for the information and assistance of agriculturists generally, as they indicate the lines which, broadly speaking, should be adopted in forming societies of this type.

The Rules for the guidance of Committees are supplemented by Rules for the members themselves, that is for the farmers who supply the milk to the depôts. These will be found of general interest, as they give directions intended to secure the production of clean and sanitary milk, and may well be followed by milk producers generally.

Rules and Regulations for the guidance of Committees and Managers of Dairy Associations affiliated to the Scottish Agricultural Organisation Society.

Membership of a Co-operative Dairy Association implies the taking out of at least one £1 share in the Soicety, payable on such calls as the committee may direct.

Interest at the rate of five per cent. per annum will be paid out of the net profits on the paid-up capital. Any balance of net profit accruing

shall be allocated in terms of the rules, which have been approved of by the Registrar of Friendly Societies and adopted by the Society at its formation.

The superiority of the depôt or creamery system over the old methods of placing milk or its manufactured products on the market being now widely recognised, it is of vital importance to the success of the undertaking that an adequate supply of milk be secured all the year round, in order to secure and retain the orders of the best class of buyers.

To attain this end, members should be held bound to supply such reasonable proportion of milk during the winter months to the quantity supplied during the summer months as the committee may deem desirable.

The milk should be delivered at the creamery or collecting depôt twice daily during the summer months, but once only during the winter months, and at such hours as the committee may find most convenient.

On Sundays, members should have the option of retaining the milk for their own use, or sending it to the creamery as they deem fit, subject, as far as possible, to the requirements of the depôt and convenience of the management.

The milk should be paid for monthly, according to the standard of quality (or otherwise as the committee may decide) at a price to be fixed from time to time by the committee, according as the market rises or falls.

The most scrupulous care should be exercised by the manager in seeing that all milk delivered at the depôt is of good quality, clean, and free from objectionable taint, as one single can of tainted or dirty milk is capable of contaminating and injuring the whole supply with which it comes in contact.

Any milk found, on inspection, to be unsatisfactory, should be put aside, and either returned or disposed of to the best advantage at the expense of the supplier.

In order to obtain the fullest benefit from co-operative trading, committees of affiliated dairy societies should enjoin their secretary or manager to keep in frequent communication with the Secretary of the Central Organisation, and keep him advised of all contracts entered into, and prices obtained, together with a list of names of buyers. It is of the utmost importance that there should be nothing in the nature of competition or cutting of prices one society against another. This can only be avoided by keeping the central office posted up with the fullest information from time to time. The Secretary of the Organisation Society will at all times be glad to advise and assist in the matter of arranging contracts, fixing prices, and securing new outlets for milk or manufactured dairy produce.

Any matter of difficulty arising at any time should at once be reported to the central office in order that the committee of local societies may have the advice and guidance of the dairy committee of the Scottish Agricultural Organisation Society.

Rules for Members of Dairy Societies, who (affiliated to the Scottish Agricultural Organisation Society) are suppliers of Milk to the Depôts.

The primary object aimed at in organising the dairy industry is to assist the producers to get a more remunerative price for their produce.

It is now generally recognised that co-operative organisation is essential to the attainment of that end.

The success of a District Association is largely influenced by the spirit of true co-operation which the members bring to bear in working together towards one common object.

To ensure that the milk sent to the depôt or creamery shall always be clean and pure, and in the best possible condition, the following simple rules should be rigidly observed by suppliers :—

1. The byres in which the cows are housed should be lime-washed twice a year, kept scrupulously clean, and thoroughly well lighted and ventilated.

2. The cows should be kept clean, and prior to milking the udders should be brushed or wiped with a damp cloth.

3. Clean overalls should be provided for the milkers to put on during milking. Care should be taken to see that the milkers' hands are perfectly clean before beginning to milk, and provision should be made in the byre for milkers cleaning and drying the hands after milking each cow.

4. The filthy practice of dipping the fingers in the milk during milking should not be allowed.

5. When necessary, the hair about the udders and tail of the cows should be clipped, in order that they may be more easily kept clean.

6. The milking pails and milk cans should be scrupulously cleansed and thoroughly scalded every time they are in use, and, where possible, exposed to the air and sun when not in use.

7. The process of milking should be carried out in the cleanest manner possible and at regular intervals. The milk is more uniform in quality when the milking periods are equally divided.

8. It is good practice to reject the first two or three strains from each teat. The first milk is poor in quality and of little value, and often contains objectionable bacteria which are harmful to the milk and its manufactured products.

9. Milk which may, from various causes, be stringy or tinged with blood must be rejected.

10. All milk should be carefully strained, immediately on being milked, through a fine strainer covered with muslin, or other modern appliance.

11. Where milk has to be conveyed for several miles before reaching the Depôt, it should be cooled by being passed over a refrigerator immediately on being milked. In the case of farms situated in near proximity to the Depôt, and when during the winter months the milk is only sent once daily to the Depôt, it should, preferably, be promptly cooled by being passed over a refrigerator, but where that is not possible it should be placed in shallow pans and kept in a cool dry milkhouse overnight, or, if placed in cans, these should be set in cold water.

12. No preservatives of any kind should ever be added to the milk. Cleanliness and prompt cooling are all that is needed to ensure its keeping sweet and in good condition.

13. Foods, such as turnips, which are calculated to impart an objectionable flavour to milk, should always be fed *immediately after milking, never before.* Turnip leaves should never be given to cows when in milk. When cows are being fed on cabbages, all decayed leaves should be kept out.

14. An adequate supply of pure water is vitally essential to the welfare of the cows, and they should never be allowed to drink impure or stagnant water.

15. No milk from newly calved cows should be sent to the Depôt for the space of four clear days from the date of calving, and no milk from any cow that is not in good health, or that is under physic, should at any time be sent.

16. When the milk is being delivered once a day only, the morning's and evening's milk must be sent in separate dishes. On no account must warm milk be mixed with cold.

17. In the event of any outbreak of contagious or infectious disease in the household of a supplier, or of any person employed by the supplier in attending the cows, notice must be at once sent to the Secretary or Manager of the Depôt or Creamery, and the supply of milk discontinued until all danger of spreading disease through the milk is certified by the Medical Officer of Health for the district to have passed.

One vitally essential factor in ensuring success is the provision by the members of an adequate supply of good well handled milk all the year round, in such proportions as the demands of the business necessitate. In order to keep up the proportionate supply required, members should arrange to have cows calving at different periods throughout the year.

Provision should be made by suppliers, as far as may be possible for a continuous supply of those field crops, suitable for milk production, to augment the daily ration when pastures fail in autumn, and for winter keep. Great loss is incurred if the milk supply is allowed to go down in consequence of failing pastures.

It is in the interest of, and should be the duty of, milk suppliers to a Co-operative Creamery not only to send in their own milk in the best possible condition, but also to see that their fellow-members do likewise.

A Voluntary System of Control in Milk Production.

A system of voluntary control of milk is in operation at Plymouth. If a farmer supplying milk to Plymouth undertakes to comply with certain conditions calculated to obviate risk of infection and to ensure a supply of clean milk, the fact is advertised once a year by the Local Authority by means of press notices and placards, and he is allowed to exhibit in the shops where his milk is sold a certificate, signed by the Medical Officer of Health, to the effect that the premises on which the milk is produced are sanitary, and that the conditions imposed by the Corporation are complied with.

The system was introduced in 1898, and the number of

farms under control has recently increased. About one-fifth of the milk supply of Plymouth is produced under the "control."

Milk from the "control" farms does not command a higher price than other milk, but large firms, hospitals, and clubs invariably deal with dairymen under the "control," and doctors recommend their patients to deal with them. Visitors coming to the town often inquire from the Medical Officer of Health where they can obtain pure milk, and though he cannot recommend an individual, he can send them a list of the "control" dairies.

The farms are inspected at least twice a year. It is found that in practice the dairy farmers under the "control" observe the conditions. There is at present no veterinary inspection of the cattle or bacteriological examination of the milk, but such inspection and examination have been suggested, and there is no doubt that the adoption of these additional precautions would increase the value of the "control," both to the producers of milk and to the public.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

EXPERIMENTS WITH ROOTS—*continued.*

Varieties of Swedes (North of Scotland Agric. Coll., Trans. of Students' Assoc., 1909).—It is pointed out in this Report that in spite of the great acreage occupied by the turnip crop in the North of Scotland, little or no data exist to show which are the varieties of turnips and swedes best suited for the various districts. This Association has, therefore, initiated a scheme to test the better-known strains of swedes and turnips. Purple Tops were tested in 1909, Green Tops will be tried this year, and Bronze Tops in 1911.

Ten varieties of Purple Top swedes were grown on nine farms. The difference between one variety and another on the same farm was often considerable, and indicated that every farmer should discover for himself by experiment the variety most suitable to his circumstances. On the average of the nine centres there was no very great difference between the varieties.

Nine varieties of swedes and turnips were tested for their power of resisting finger-and-toe. Of the swedes the best was Bruce's Buchan, with 91 per cent. of sound bulbs, and of yellow turnips, Climax and Victor Achilles with 84 per cent. of sound bulbs. The trials are being continued.

* The summaries of agricultural experiments which have appeared in the present volume have been as follows:—Cereals, April; Cereals and Root Crops, May. The Board would be glad to receive for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

Manuring of Swedes (*Lancs. C.C. Educ. Committee, Farmers' Bull.* No. 16).—An experiment was carried out on four farms in 1907 and six in 1908 to find (1) whether it is more profitable to use a heavy dressing of farmyard manure than a moderate dressing supplemented by artificials, (2) whether it is necessary to use a complete mixture of artificials with the moderate dressing of farmyard manure.

In this experiment, the phosphatic manure was made the starting point of the scheme of manuring. It has been shown in other experiments that when used with farmyard manure, phosphates are the most important of the constituents used in artificial manures for swedes, both in determining the growth of the crop during summer and its ultimate weight at pulling time. Previous experiments have also shown that the addition to a phosphatic manure of either nitrogen or potash or both, may bring about only a small increase which is often insufficient to pay for the cost of the extra manures.

The present experiment did not, however, altogether support this view. The addition of 4 cwt. of superphosphate to 10 tons of farmyard manure raised the crops from 22 tons 19 cwt. to 24 tons 12 cwt., while the addition of 1 cwt. of sulphate of ammonia increased it to 26 tons 13 cwt., and gave a profit, after paying for the manure, of 22*s.* 2*d.* When this mixture was made a "complete" manure by the addition of 3 cwt. of kainit, the crop obtained was 27 tons 7 cwt., and the profit 22*s.* 1*d.* The substitution of 1¼ cwt. of nitrate of soda for the sulphate of ammonia gave 28 tons 1 cwt. and a profit of 30*s.* 1*d.* The results, therefore, seem to suggest that superphosphate and nitrate of soda are likely to give the best results, and that the increase obtained by the use of kainit may be insufficient to justify its use.

In comparing light and heavy dressings of dung, it was found that the crop produced by 10 tons of farmyard manure was 22 tons 19 cwt. per acre, while with 20 tons of farmyard manure it was 25 tons 13 cwt., a difference of only 2 tons 14 cwt., which would not cover the cost of the extra 10 tons of manure. It will be seen from the figures given above that a dressing of suitable artificials in conjunction with 10 tons of farmyard manure is likely to give larger and more profitable crops than 20 tons of farmyard manure alone.

The following dressing is recommended in the Report as the result of these experiments:—

Farmyard manure	10 tons.
Superphosphate	4 cwt.
Nitrate of soda	1 cwt.

The superphosphate and half the nitrate of soda should be broad-casted over the drills before the farmyard manure is covered up. After singling, and when the plants have become established, the remainder of the nitrate of soda should be applied.

Manuring of Mangolds (*Roy. Agric. Coll., Cirencester, Agric. Students' Gazette, December,* 1909).—All the plots on which this experiment was conducted were dressed with 12 tons per acre of farmyard manure. Eleven different mixtures of artificials were then applied, each plot being in duplicate. The soil varied in depth and texture considerably, and the difference between duplicate plots was in some

cases large. Only the produce of $\frac{1}{80}$th of an acre was weighed, and errors are likely to have arisen from this cause. All the nitrogenous manures gave an increase, though not always sufficient to show a profit when the cost of the dressing was taken into account. The heaviest crops were given by 3 cwt. of superphosphate and 4 cwt. kainit, together with either 1 cwt. sulphate of ammonia, 143 lb. nitrate of soda, or 175 lb. nitrate of lime, these amounts containing equivalent quantities of nitrogen. When the roots were valued at 10*s*. a ton these three mixtures all showed a profit.

A second experiment was intended to test the effect of kainit and of nitrogen in four different forms. No farmyard manure was applied, but all the plots received 3 cwt. per acre of superphosphate. The plots in this experiment also were very irregular, and the area weighed was very small. The general result was to favour the employment of a "complete" manure. Taking the average of the six plots receiving kainit, superphosphate, and nitrogenous manures, against the average of the five plots receiving superphosphate and nitrogenous manures only, there was an increase in yield of $3\frac{1}{2}$ tons of roots in favour of the complete mixture.

Experiments with Mangolds (*Harper Adams Agric. Coll., Report on Field Expts.,* 1909).—A test of nine varieties of mangolds was made at the College farm, and the following were the best yields :—Leighton's Rentpayer 45 tons 3 cwt., Sutton's Prizewinner Yellow Globe 44 tons 4 cwt., Dickson and Robinson's Eclipse Red 43 tons 16 cwt. The next in yield was 8 tons below this last.

Trials have been carried out in the years 1907–9 to ascertain whether top dressings of nitrate of soda and superphosphate can be profitably used in addition to a complete dressing of manure. The standard dressing consisted of dissolved bones $3\frac{1}{3}$ cwt., sulphate of ammonia 1 cwt., sulphate of potash 1 cwt., farmyard manure 15 tons. On the average of the three years this gave a yield of 48 tons 7 cwt. per acre on one plot and 47 tons 13 cwt. on another, while that of the unmanured plot was 34 tons 12 cwt. A top dressing of 1 cwt. nitrate of soda produced a further increase of 2 tons 4 cwt., and 2 cwt. produced one of 5 tons. No further increase was obtained with more than 2 cwt. The results as regards superphosphate, used as a top-dressing, varied too much for definite conclusions to be drawn.

A trial of the new potassic superphosphate, basic slag, and superphosphate as manures for mangolds was made in 1908, and repeated in 1909, quantities costing approximately the same being applied. Each plot was dressed with 15 tons per acre of farmyard manure during the winter, and the following were the additional manures applied. Plot 1, 6 cwt. of potassic superphosphate; Plot 2, 8 cwt. of basic slag; and Plot 3, $7\frac{3}{4}$ cwt. of superphosphate. In each year the basic slag produced the heaviest crop. On the average of the two years the cost of the artificial manures per ton of roots produced was, basic slag $6\frac{1}{2}$*d*., superphosphate $6\frac{3}{4}$*d*., potassic superphosphate $7\frac{3}{4}$*d*.

The value of salt was tested in the three years 1907–9. The salt was applied across all the manurial and variety trial plots, and was thoroughly worked into the soil by cultivating, harrowing, and rolling three times before ridging up, the ridges being again split before

sowing. If the salt is not completely mixed with the soil, the seed is liable to be damaged. The application of $2\frac{1}{2}$ cwt. per acre gave an average increase in two years of 3 tons 18 cwt.; 5 cwt. and 10 cwt. gave an average increase during three years of 5 tons 10 cwt. and 8 tons 6 cwt. respectively. The results varied a good deal from year to year, and in 1909 the effect was much less than in the two preceding years, 10 cwt. of salt giving an increase of 3 tons 4 cwt. only, while 15 cwt., tried for the first time that year, gave an increase of 3 tons 17 cwt. only.

In another experiment a number of purchased compound manures which are intended for mangolds were compared.

Experiments with four different nitrogenous manures were also carried out at three centres in Staffordshire. The object of these experiments was to compare the new nitrogenous manures, calcium cyanamide and nitrate of lime, with nitrate of soda and sulphate of ammonia. In each case an equal amount of nitrogen was applied together with 15 tons farmyard manure, 4 cwt. steamed bones, 2 cwt. superphosphate, and 3 cwt. kainit. The results varied at each centre, the most striking feature being a remarkable increase of 14 tons at one centre, which apparently resulted from the use of nitrate of lime, whereas the other nitrogenous manures only gave an increase of from 2 to 4 tons.

Experiments with Swedes (*Harper Adams Agric. Coll., Report on Field Expts.*, 1909).—Eleven varieties of swedes were compared. The season was wet and finger-and-toe considerably reduced the crop. The following were the best yields:—New Tankard (Garton), Modern (Leighton), Model (Garton), and Lord Derby (Leighton). All these gave crops of between 18 and 20 tons per acre.

A comparison of various phosphatic manures was made, a quantity costing £1 being applied in each case. In 1909 there was little difference in the results. On the average of three years bone meal has given slightly better results than superphosphate and dissolved bones, and these in turn have done better than steamed bones and basic slag.

In a similar comparison of nitrogenous manures equal money values of sulphate of ammonia, calcium cyanamide, nitrate of soda, nitrate of lime, and a mixture of nitrate of soda and sulphate of ammonia were applied in conjunction with a standard dressing of steamed bones 4 cwt., superphosphate 3 cwt., and kainit 2 cwt. In this case, also, there was not much difference in the resulting crops, but the average of five years is slightly in favour of sulphate of ammonia.

Potash manures were also compared, the superphosphate and kainit in the standard dressing used in the nitrogenous trials being tried against an equal money value of potassic superphosphate. Only $3\frac{1}{2}$ cwt. of the latter could be purchased for the same money as 3 cwt. of superphosphate and 2 cwt. of kainit together, and this quantity did not prove to have an equal manurial value, as the crop grown on this plot was smaller by 1 ton 13 cwt., and on the average of two years by 2 tons 6 cwt.

An experiment was also carried out with a number of compound manures sold for the swede crop and two home-mixed compounds.

A trial was carried out to compare the value of basic slag and superphosphate as manures for swedes as expressed by the feeding

value of the roots. Two areas of half an acre each were dressed with 10½ cwt. basic slag and 7½ cwt. superphosphate at a cost of £1 each, and the produce was 16 tons 10 cwt. and 17 tons 12 cwt. respectively. The roots were consumed by sheep and their live weight and selling price compared. The conclusion is drawn that the swedes grown with slag have given a greater monetary return per acre. The gain in live weight for twenty sheep was about 2½ cwt. in the case of the swedes grown with basic slag, and about 2 cwt. in the case of those grown with superphosphate.

Manurial experiments on swedes were conducted at two centres in Staffordshire. In one a special compound turnip manure was compared with a home-made mixture containing equal amounts of nitrogen, phosphates and potash. The latter cost 4*s.* 6*d.* per acre less and gave better results at two centres.

Manuring of Mangolds (*Univ. Coll., Reading, Bull. vii. Results of Expts. at the College Farm,* 1909).—An experiment was conducted on the effect of different nitrogenous manures. Five plots of one-twentieth acre each were dressed with 4 cwt. superphosphate and 3½ cwt. kainit. Four of them then received 1½ cwt. of calcium cyanamide, nitrate of lime, nitrate of soda, or sulphate of ammonia respectively. Taking the average of the three years 1907–9 the yields obtained from calcium cyanamide and sulphate of ammonia were both about 33 tons, while the nitrate of lime and nitrate of soda gave about 35 tons. The 1909 results pointed to the advisability of sowing the calcium cyanamide before the seed. In previous years the leaves of the young plants were damaged when this manure was applied as a top-dressing, and although the plants sent out new leaves, this temporary check cannot be good.

In another experiment in 1909 half-acre plots were used. All were manured with 15 tons dung, 4 cwt. superphosphate, and 3½ cwt. kainit per acre. The same nitrogenous manures were applied in quantities of 1½ cwt., except for sulphate of ammonia, of which 126 lb. were used. The results were: Calcium cyanamide 33 tons 16 cwt., nitrate of lime 30 tons 6 cwt., nitrate of soda 34 tons, sulphate of ammonia 35 tons 14 cwt.

Manuring of Swedes (*Univ. Coll., Reading, Bull. vii. Results of Expts. at the College Farm,* 1909, *and Bull. viii., Trials carried out for the Oxford C.C.,* 1909).—The effect of a commercial swede manure was compared with that of a home-mixed manure of the same analysis. Two one-eighth acre plots were used, and the former manure, costing £8 per ton, was applied at the rate of 4 cwt. per acre. The home-mixed manure was composed of sulphate of ammonia 6·7 lb., superphosphate (26 per cent. soluble) 77 lb., kainit 8 lb. The yields over two years averaged 15 tons 17 cwt. per acre for the commercial manure and 16 tons 6 cwt. per acre for the other. Thus a slightly better result was obtained by using a home-mixed manure costing £1 3*s.* 3*d.* per acre, compared with a purchased swede manure costing £1 12*s.* per acre.

Experiments were also conducted at six centres in Oxfordshire on behalf of the County Council, for the purpose of illustrating the effect on the crop of various phosphatic manures used singly and in combination with other artificials.

Of the phosphatic manures applied, superphosphate seems to have given the best results, both when used singly and in combination with

other artificials. Steamed bone flour showed much less effect than either superphosphate or slag. The addition of sulphate of ammonia and sulphate of potash to the superphosphate gave an increase of 25 cwt. and the best average result.

Manuring of Mangolds and Swedes (*Wilts. C.C., Results of Field Manurial Demonstration,* 1908–9).—Six experiments on the manuring of mangolds and six on the manuring of swedes were carried out at different centres in the county.

The schemes on which these demonstrations were carried out received the general approval of the Board of Agriculture and Fisheries, and were largely based on the schemes submitted to the Board by the Agricultural Education Association. They appear to have been very carefully carried out, and this report gives the results obtained at each centre, together with full particulars as to the soil, weather, and previous cropping.

In the case both of the mangold and the swede experiment, there were eight plots at each centre, the area of each plot being eight perches. One plot received no artificial manure, one plot received a complete dressing comprising kainit, superphosphate, and nitrate of soda, three plots received dressings composed of two of these manures, and three plots dressings of each manure alone. The quantities in the mangold experiment were as follows:—Kainit, $5\frac{5}{8}$ cwt.; superphosphate, 6 cwt.; and nitrate of soda, $2\frac{3}{8}$ cwt. per acre. In the swede experiment, the quantities were: kainit, $2\frac{7}{8}$ cwt.; superphosphate, 6 cwt.; and sulphate of ammonia $\frac{7}{8}$ cwt.

On the average of all the mangold centres, the complete dressing gave satisfactory results, the increase amounting to $11\frac{3}{4}$ tons, or about 53*s.*, after deducting the cost of the manure. The increase at one centre was under 3 tons, but elsewhere it ranged from $9\frac{1}{2}$ to $19\frac{3}{4}$ tons. The plots which received kainit and nitrate of soda did equally well, and owing to the smaller cost of manures the net gain averaged 68*s.* per acre. Superphosphate and nitrate of soda gave an average gain of 9 tons 2 cwt., and superphosphate and kainit a gain of 7 tons 13 cwt., representing in money 43*s.* and 39*s.* respectively. The results from the plots receiving only a single manure were lower, averaging from $3\frac{1}{2}$ to $4\frac{1}{2}$ tons.

The general tendency of the experiments is in favour of kainit and nitrate of soda, which gave a better result than the complete manure at four out of the six centres at a smaller cost.

In the case of the swede experiments, the results at one centre were irregular and produced very little result, owing to the wet season. Taking the average of the other five, the best result was obtained from the complete manure, which gave an increase of nearly 11 tons per acre, or a gain, after deducting the cost of the manure, of 87*s.* 6*d.* per acre. Kainit and superphosphate, and kainit and sulphate of ammonia, gave approximately similar results, with averages of 7 tons 15 cwt. and 7 tons 8 cwt. per acre, or gains of 62*s.* 8*d.* and 64*s.* respectively per acre. Superphosphate by itself gave 7 tons 1 cwt., or a gain of 62*s.*, so that the addition of kainit to this manure had apparently little effect; in fact, at two centres superphosphate alone gave a higher result. In the same way the application of sulphate of ammonia, in addition to the superphosphate, produced no further

increase. The results of these experiments, therefore, seem to be entirely in favour of a complete dressing.

FOREIGN EXPERIMENTS.

Cold Storage of Poultry (*U.S. Dept. of Agriculture*).—A report by Dr. Mary E. Pennington, of the Bureau of Chemistry, on the changes which take place in chickens when kept in a frozen condition for various periods, is included in the Year-Book of the United States Department of Agriculture for 1907. The opinion is prevalent in the cold-storage trade in the United States that poultry may be kept for long periods without any appreciable change, and it is stated that foodstuffs are thus kept for months and even years before being placed on sale. In order to test this point chickens were picked at random from the stock coming to a cold-storage warehouse, and placed undrawn in a refrigerator at a temperature of from 13° to 15° Fahr. A chicken was removed after ten months and thawed in water. It was found that the exterior was somewhat dried, and there was a marked drying-out of the muscle and tissue, with a deepening of tint, but the chicken was still a good palatable-looking bird. A second bird was removed after two years, when its appearance was markedly different from that of a fresh bird. The skin was leathery and the muscles were discoloured, shrunken, and dry. The odour of the chicken was unpleasant, though not that commonly described as putrefactive. After exposure to the air for a few hours the odour had increased and become similar to that of putrid flesh.

In the case of a chicken frozen for three years, these changes had progressed much further, and, in addition, it had become stiff. The appearance and odour of the bird were unpleasant in the extreme; the skin was green, and the muscles dried out, while the fat had changed from a light yellow colour to a deep brown-orange. After thawing the keeping quality of this chicken was practically nil. These results show that the opinion that there is no change in cold-storage poultry cannot be accepted in its entirety. Both microscopic study and the taste of the cooked fowl confirm the opinion gathered from its appearance that degeneration does take place.

In an address before the American Warehousemen's Association (*National Provisioner,* Jan. 22, 1910), Dr. Pennington described some further experiments, and pointed out that the treatment of the poultry before storage has an important bearing on the result. Changes may be set up between the time of killing and the receipt of the birds at the warehouse, and though the subsequent changes take place at a much slower rate in a temperature below freezing point, they are not entirely stopped.

Chickens were dressed in the two ways employed under commercial conditions : (1) picked dry and chilled in cold air, (2) scalded by plunging for from ten to fifteen seconds in water a little below boiling point, after which the feathers were rubbed off and the birds chilled in cold air or water. The dry-picked birds and the scalded birds were divided into two lots, part being stored promptly and part kept twenty-four hours at unfavourable temperatures without chilling or storage. They were then wrapped in parchment paper and packed in a box lined with parchment paper, and nailed or fastened in the usual manner.

Some were packed in watertight boxes. The birds were removed from cold storage at the end of three, six, and nine months. Those stored promptly after dry picking were all in good condition, the one that had been stored for nine months being a little inferior in appearance and smell to the other two. The birds kept for three and six months could hardly be distinguished from a fresh bird. The chickens that were delayed at a temperature of 80° for twenty-four hours after dressing, though they appeared to be in perfectly fresh condition when stored, were in each case distinctly inferior when removed from storage to the birds stored without delay. At the end of nine months there was a decided loss of quality to such an extent that the birds, when subjected after thawing to the delay and treatment of retailing, would be in bad condition.

The scalded birds suffered more through storing than those that were dry-picked, and were inclined to vary more in their behaviour. One that was delayed before freezing was, after nine months, uneatable.

A number of the chickens were examined bacteriologically after storing, and the results showed a very much greater number of bacteria in those that were not frozen promptly, the number being increased when the birds were drawn before being frozen. To keep poultry in good condition, dry picking, dry chilling, and prompt storage are indicated as the best methods.

OFFICIAL NOTICES AND CIRCULARS.

American Gooseberry Mildew in Norfolk.

The following notice was issued on May 13th :—The Board of Agriculture and Fisheries have received information that the summer stage of American Gooseberry Mildew (*Sphaerotheca Mors uvae*) was discovered in a Norfolk garden on the 12th inst. All gooseberry growers are advised to examine their bushes carefully, and should any sign of disease be found, to spray their bushes with a solution of liver of sulphur (one pound to thirty-two gallons of water). A leaflet describing the disease, and giving directions for dealing with it, can be obtained from the Secretary, Board of Agriculture and Fisheries, Whitehall Place, London, S.W., gratis and post free. Letters so addressed need not be stamped.

Destructive Insects and Pests Order of 1910.

The Board of Agriculture and Fisheries, by virtue and in exercise of the powers vested in them under the Destructive Insects and Pests Acts, 1877 and 1907, do order, and it is hereby ordered, as follows :—

Notification of Discovery of Insect or Pest.

(1)—(1) The occupier of any premises on which an insect or pest mentioned in the Schedule to this Order exists, shall forthwith notify the fact, with particulars of the time and place of discovery, to the officer appointed by the Local Authority to receive such notices, or, if no such officer has been appointed, to the Board; and, where practicable, a specimen of the insect or pest shall accompany the notice.

(2) An officer of a Local Authority who receives a notice under this Article shall forthwith report the fact to the Local Authority.

(3) The Local Authority on receiving in any manner notice of the existence or apparent existence of an insect or pest mentioned in the Schedule to this Order shall forthwith transmit the information to the Board and take such steps as may be necessary to determine to what extent the insect or pest exists.

Powers of Entry.

(2)—An Inspector or other officer appointed in that behalf by the Local Authority, and any Inspector of the Board may, upon production if so required of his appointment or authority, enter any premises on which he has reason to believe that an insect or pest mentioned in the Schedule to this Order exists or has recently existed, and examine any plant, fruit, crop, seeds, tubers, bulbs, layers or cuttings on such premises.

Action to be taken by Local Authority.

(3)—(1) An Inspector or other officer of the Local Authority or of the Board, acting under their direction, may at any time and from time to time by a notice served on an occupier of premises on which an insect or pest mentioned in the Schedule hereto exists or recently has existed, require him to adopt such measures for prevention of the spread of the insect or pest as are specified in the notice.

(2) Where a Local Authority have consented to pay compensation for such destruction, the notice under this Article may require the occupier of premises on which an insect or pest mentioned in the Schedule hereto exists or recently has existed, to destroy by burning or other effective method all or any of the plants, fruit or crops on the premises, and the Local Authority shall pay compensation for such destruction subject and according to the provisions in that behalf of the Destructive Insects and Pests Acts, 1877 and 1907.

(3) A notice under this Article may prescribe the time within which the adoption of any measure thereby prescribed shall be completed.

(4) An occupier may appeal to the Board against a notice, served on him under this Article by an Inspector or other officer of the Local Authority, and the Board may, after consultation with the Local Authority, cancel the notice or modify its requirements in such manner as the Board think fit.

(5) For the purposes of this Order a notice shall be deemed to be served on a person if it is delivered to him personally or left for him at his last known place of abode or business, or sent through the post in a letter addressed to him there, and a notice or other document purporting to be signed by an Inspector or other officer of a Local Authority or of the Board, shall be *primâ facie* evidence that it was signed by him acting under the directions of the Local Authority or the Board as the case may be.

Penalty on Sale or Use for Planting of Diseased Seeds, &c.

(4)—Every person who shall knowingly use, or sell for use, for planting any plant, seed, tuber, bulb, layer or cutting attacked by an insect or pest mentioned in the Schedule to this Order, or any seed, tuber, bulb, layer or cutting which has been derived from a plant so

attacked and is capable of spreading the insect or pest, shall be liable on conviction to a penalty not exceeding ten pounds.

Prohibition of Sale of Specimens.

(5)—It shall not be lawful, except with the written permission of the Board, to import, sell, or offer for sale, a living specimen of any insect or pest mentioned in the Schedule to this Order.

Penalties.

(6)—Every person shall be liable on conviction to a penalty not exceeding ten pounds who—

(1) Knowingly fails to give such notification as is required by Article 1 of this Order; or

(2) Fails to adopt such measures for prevention of the spread of the disease as are specified in a notice served on him under this Order; or

(3) Wilfully obstructs or impedes any Inspector or other officer when acting under this Order; or

(4) Imports, sells or offers for sale an insect or pest in contravention of this Order.

Notification of Order.

(7)—This Order shall be published by the Local Authority in accordance with any direction given by the Board.

Revocation of Order.

(8)—The Destructive Insects and Pests Order of 1908 is hereby revoked.

Execution of the Order.

(9)—Each Local Authority shall carry into effect this Order within their District, and shall appoint such Inspectors or other officers for that purpose as may be necessary.

Definitions.

(10)—In this Order—

"The Board" means the Board of Agriculture and Fisheries;

"Local Authority" means a local authority having power to execute and enforce the Diseases of Animals Act, 1894; and "District" means the area in which the Local Authority has such power to act.

Application of the Order.

(11)—This Order shall apply to Great Britain.

Short Title.

(12)—This order may be cited as the DESTRUCTIVE INSECTS AND PESTS ORDER OF 1910.

In witness whereof the Board of Agriculture and Fisheries have hereunto set their Official Seal this third day of May, nineteen hundred and ten.

T. H. MIDDLETON,
Assistant-Secretary.

SCHEDULE.

Insects and Pests to which this Order applies.

The Vine Louse (*Phylloxera vastatrix,* Planchon).

The San José Scale (*Aspidiotus perniciosus,* Comstock).

The Mediterranean Fruit Fly (*Ceratitis capitata*, Wiedemann).
The Colorado Beetle (*Doryphora decemlineata*, Say).
The Large Larch Sawfly (*Nematus erichsonii*, Hartig).
The Potato Moth (*Lita solanella*, Boisduval).
The Gipsy Moth (*Liparis* [*Ocneria*] *dispar*, Linné).
The Brown Tail Moth (*Euproctis chrysorrhœa*, Linné).
The Nun Moth (*Liparis monacha*, Linné).
The Cherry Fly (*Rhagoletis cerasi*, Linné).
The Narcissus Fly (*Merodon equestris*, Fabricius).
Black Knot (*Plowrightia morbosa*, Saccardo).
Wart Disease or Black Scab of Potatoes (*Synchitrium endobioticum*, Percival).
Tomato Leaf Spot (*Septoria lycopersici*, Spegazzini).
Melon or Cucumber Canker (*Mycosphœrella citrullina*, Grossenbacher).
American Pear Blight (*Micrococcus amylovorus*, Burrell).

The following Circular letter, dated April 18th, 1910, has been addressed by the Local Government Board to Union Assessment Committees on the subject of the assessment of woodlands (see Leaflet No. 8):—

Assessment of Woodlands.

SIR,—I am directed by the Local Government Board to inform you that it has been represented to the Board by a Committee appointed at the British Timber Conference held in London last year, that Union Assessment Committees throughout England have generally failed "to properly appreciate and act upon the provisions of the Rating Act, 1874," in regard to the assessment of woodlands.

The Committee urge the Board to communicate with Assessment Committees and to point out that woodlands should be assessed at their "unimproved" value which is practically "prairie" value. They state that though "prairie" value represents on the average about half-a-crown per annum per acre, yet many of the woodlands of England are rated at figures four and five times greater.

The Committee state further that they are aware that an occupier of woodlands who is over-assessed can obtain redress by an appeal to Special or Quarter Sessions, but that the costs of such an appeal are out of all proportion to the saving of rates effected by a successful appeal, and consequently the illegal over-assessments remain, and the benefits of the Rating Act of 1874, so necessary for the promotion and encouragement of Afforestation, do not in fact reach the occupier of woodlands.

The Board have no jurisdiction to lay down any rules for the guidance of Assessment Committees in the matter, but in view of the representations which have been made to them, they desire to call the attention of the Assessment Committee to the following observations upon the provisions of the Act of 1874 contained in the Circular addressed to Assessment Committees on the 24th November, 1874.

The Act classifies woodland under three heads, viz. :—

(1) Land used only as a plantation or a wood.

(2) Land used for the growth of saleable underwood.

(3) Land used both for a plantation or a wood, and also for the growth of saleable underwood.

(1) In the first case, viz., where the land is used only for a plantation or a wood, and not for the growth of saleable underwood, the Act provides that the gross and rateable value (meaning by gross value the gross estimated rental, as defined by the Union Assessment Committee Act, 1862) shall be estimated as if the land, instead of being a plantation or a wood, were let and occupied in its natural and unimproved state.

It is the duty, therefore, of the Assessment Committee to deal with the land as if it were divested of timber or wood of any description, and to determine its value without taking into account any improvement which has been made, or of which the land might be capable.

It will be observed that the words used are "as if the land, instead of being a plantation or a wood, were let and *occupied* in its natural and unimproved state," and the word "occupied" was introduced in order to show clearly that the capabilities of the land for improvement were to be excluded from consideration in estimating the rent at which it might reasonably be expected to let from year to year, and that the land was to be valued as if it would continue to be occupied in its natural state, without any expenditure of capital in its improvement; or, in other words, as if it were waste land.

(2) The second case is that of land used exclusively for the growth of saleable underwood; and the statute requires that in such case the value shall be estimated as if the land were let for that purpose.

(3) With respect to the third case of composite woods, *i.e.,* where the land is used both for a plantation or a wood, and also for the growth of saleable underwood, the value is to be estimated either as if the land were used only for a plantation or a wood, or as if the land were used only for the growth of the saleable underwood growing thereon, as the Assessment Committee may determine.

In this case, therefore, it is entirely within the discretion of the Assessment Committee to adopt either alternative; but it must be borne in mind that if they assess the land as if it were used for the growth of saleable underwood, the land cannot be valued as if it were let for the growth of saleable underwood, and capable of improvement for that purpose, but only in respect of the saleable underwood actually growing thereon, irrespective of any capacity for improvement by the removal of trees or otherwise.

It should be added that woodlands, which are subject to rights of common, are not rendered rateable by the Act.

In connection with the foregoing provisions of the Act, the Board may call attention to the decisions in two cases which have come before the Courts.

In the case of the *Earl of Westmorland* v. *Southwick and Oundle* (1877), 36 L.T. n.s. 108; 41 J.P. 231, it was decided that in ascertaining the rateable value of a plantation or wood as "land let and occupied in its natural and unimproved state," it was not admissible to base the estimate upon the rent which a hypothetical tenant would give if expenditure were incurred in draining, fencing, or other improvements. In the case of *Eyton* v. *Mold Churchwardens and Overseers* (1880, L.R., 6 Q.B.D. 13, 50 L.J.M.C. 39; 43 L.T. 472, it was held that the value

of a right of sporting over land might properly be included in estimating the rateable value of a plantation or wood as land in its natural and unimproved state.

The Board request that the matter may have the consideration of the Assessment Committee with a view to determining whether there are any cases in their district in which the assessment of woodlands calls for revision.

I am, &c.,

H. C. MONRO, *Secretary*.

Prescriptions for Sheep-Dips.

The following prescriptions for Sheep-Dips have been approved by the Board of Agriculture and Fisheries for Sheep Scab, and can be used by sheep owners who prefer to make up their own dips.

(1) LIME AND SULPHUR.—Mix 25 lb. of flowers of sulphur with $12\frac{1}{2}$ lb. of good quicklime. Pound or rub the mixture with water until a smooth cream without lumps is obtained. Transfer this to a boiler capable of boiling 20 gallons; add to the mixture sufficient water to make up 20 gallons; boil and stir for half an hour. The liquid should then be of a dark red colour; if yellowish, continue the boiling until the dark red colour is obtained, keeping the amount of liquid up to 20 gallons by adding water if necessary.

Half the above quantities may be used to make 10 gallons, if more convenient.

After the liquid has cooled, pour it off from any small quantity of insoluble sediment.

To 20 gallons of the mixture add 80 gallons of water to make a bath.

The mixture will keep good for twenty-four hours if kept in a covered vessel, and for a month or even more if kept in jars or drums securely corked.

Period of immersion for sheep in this dip, not less than half a minute.

(2) CARBOLIC ACID AND SOFT SOAP.—Dissolve 5 lb. of good soft soap, with gentle warming, in 3 quarts of liquid carbolic acid (containing not less than 97 per cent. of real tar acid). Mix the liquid with enough water to make 100 gallons for the bath.

This mixture after being prepared will keep good for three months if kept in securely stoppered jars or drums in a cool place.

Period of immersion for sheep in this dip, not less than half a minute.

(3) TOBACCO AND SULPHUR.—Steep 35 lb. of finely ground tobacco (known as offal tobacco) in 21 gallons of water for four days. Strain off the liquid and remove the last portions of the extract by pressing the remaining tobacco. Mix the whole extract and add to it 10 lb. of flowers of sulphur. Stir the mixture well, to secure its being evenly mixed, and add sufficient water to make up 100 gallons for the bath.

This mixture will not keep.

Period of immersion for sheep in this dip, not less than half a minute.

In every case the dip-bath should be of sufficient volume to allow of each sheep being completely immersed in the bath.

Where a number of sheep are to be dipped, the bath must be cleaned out from time to time, otherwise the efficacy of the dipping may be impaired.

The dip-bath should not be made up by mixing together different kinds of dip.

Caution to Flock-owners in regard to the Dipping of Sheep.

The dipping of sheep is the only practicable and certain remedy for sheep-scab, and two dippings within twenty-one days are necessary for a complete cure, since the unhatched acari of sheep-scab are not always killed by the dip. The second dipping should take place between the tenth and twenty-first day. During the interval any eggs not destroyed by the first dipping will most probably have hatched out, but the laying of eggs by the new generation of acari will not have commenced, so that when the second dipping takes place there will be only living acari to destroy. Dipping must be efficiently and effectually carried out as regards each sheep.

Sheep-scab may exist unrecognised in a flock for from two to three months or even longer, and usually manifests itself in early winter. If, as a matter of precaution, all sheep in a district are twice dipped at the above intervals the disease should be effectually eradicated in a year or two provided that all persons concerned co-operate in making the dipping thorough and complete, and that any outbreaks of sheep-scab that occur in the interval are energetically dealt with under the Sheep-Scab Order of 1905.

Dipping to be effective against sheep-scab must be carried out with an efficient dip, and a dip bath of sufficient volume must be made up strictly in accordance with the directions issued by the makers of the dip. Each sheep must be completely immersed for the period required by the directions, and the dip bath must be at all times kept up to the required strength, and be kept clear of dirt.

To comply with the Board's Orders requiring dipping of sheep the dip must be one approved by the Board, under the Sheep-Scab Order of 1905. Approved dips have to contain sufficient of one constituent to make the dip effective for the cure of sheep-scab at the strength approved. It is therefore inadvisable to make up the dip bath by mixing two or more dips containing different ingredients, even in cases where each dip has been approved for use by itself. For example, to mix carbolic and arsenic dips may result in destroying the efficacy of both ingredients, and even the mixing of dips containing the same ingredients may result in the bath being below standard. In some cases, also, the use of mixed dips may injure the sheep.

Unless the above requirements are strictly carried out the whole utility of the dipping operation may be nullified and the labour of collecting and dipping the sheep, as well as the money expended on the purchase of the dip, be thrown away.

Where a professional sheep dipper is employed the flockowner should be careful to satisfy himself that the dip used is an approved one by requiring the production of the Board's approval. In cases of doubt a sample of the dip should be taken for the purposes of analysis.

RECENT PUBLICATIONS OF THE BOARD OF AGRICULTURE AND FISHERIES.

The most recent publication of the Board of Agriculture and Fisheries is an illustrated handbook descriptive of the principal British breeds of live stock.

British Breeds of Live Stock.

This handbook was originally prepared for the information of foreign agriculturists visiting the Brussels and Buenos Aires International Exhibitions of 1910, but it will probably be found to be of service to all who are interested in the breeding of live stock, whether for exportation or otherwise.

It contains an account of the principal characteristics of all the British breeds of horses, cattle, sheep, pigs, and poultry, with a brief history of their origin, and of some of the principal animals which have formed the foundation stock of the pedigree animals of the present day. A statement is also given of the more important shows and places at which the animals of each breed can be bought, together with an indication of the average prices.

The handbook is illustrated by some ninety photographs of animals of the different breeds. Copies can be obtained from the Office of the Board, 8 Whitehall Place, S.W., price 1*s.* each, post free.

For distribution at the exhibitions it has been translated into French, German, and Spanish, and copies in these languages can be obtained at the same price.

The series of coloured plates of Edible and Poisonous Fungi, which are appearing in this *Journal,* have now been issued separately.

Coloured Plates of Edible and Poisonous Fungi.

The pamphlet contains twenty-five plates, and is intended to enable residents in the country to distinguish accurately between poisonous and edible kinds of fungi, and thus possibly to utilise to a greater extent those varieties useful for food.

It can be obtained from the Office of the Board, 8 Whitehall Place, S.W., price 1*s.*, post free.

The following is a list of leaflets which have been recently issued or are in course of preparation :—No. 207, Strawberry Cultivation; No.

Recent Leaflets.

227, Swine Erysipelas; No. 228, Prevention of Cruelty in the Destruction of Hares, Rabbits, &c.; No. 229, Breeding and Rearing of Turkeys; No. 230, Cucumber and Tomato Canker; No. 231, Cheese-making for Small Holders; No. 232, Corky Scab of Potatoes; No. 233, Actinomycosis; No. 234, Leaf Shedding in Conifers caused by *Botrytis*; No. 235, The Organisation of the Milk Supply; No. 236, Thatching; No. 237, Redwater in Cattle; and No. 238, Leaf Diseases of Celery.

New editions of the following leaflets have been prepared, the information having been substantially revised :—

No. 18.—Fertilisers and Feeding Stuffs Regulations.—The regulations recently issued as to "Limits of Error" have been added.

No. 28.—Anthrax.—Information as to methods of preventive inoculation has been added.

No. 70.—Winter Washing of Fruit Trees.—Advice has been added to this leaflet as to the treatment of neglected orchards, both as regards insect and fungoid pests, and regrafting and replanting. The information as to winter washing has also been revised.

No. 71.—Colorado Beetle.—This leaflet has been re-written and re-issued with new illustrations.

No. 97.—Farmers' Co-operative Societies, and No. 111, Co-operative Egg and Poultry Societies.—These leaflets have been re-written to make them more applicable to present conditions.

No. 110.—Carriage of Goods by Rail at Owner's Risk Rates.—This leaflet contains certain new conditions which were agreed upon at the Railway Conference, and takes the place of the leaflet entitled, "Carriage of Milk by Rail in Locked Cans," which is incorporated with the new leaflet.

A large number of other leaflets have also been revised and amended without being entirely rewritten.

Supplement to the Journal.

In order to bring to the notice of British farmers the valuable papers relating to the growth and composition of wheat, which were read at the Meeting of the British Association at Winnipeg in 1909, the Board of Agriculture and Fisheries have obtained the consent of the Association to their publication as a Supplement to the *Journal of the Board of Agriculture*. This Supplement is issued with the present number.

The papers it contains will be found to give in a concise form a summary of the experimental work which has been done in the production of new varieties of wheat and of recent research into the composition of wheat and flour.

Copies are sent to subscribers free, but the Supplement can be purchased separately, price 4*d.*, post free.

The following is a list of the Supplements which have been issued up to the present :—

No. 1.—Agricultural Education in the United States, January 1908.

No. 2.—The Food of Some British Birds, December, 1908.

No. 3.—Work of the International Agricultural Institute at Rome, April, 1910.

No. 4.—Wheat.—Papers read at the Meeting of the British Association at Winnipeg in 1909. June, 1910.

Annual Reports.

The Report of the Proceedings of the Board of Agriculture and Fisheries under the Acts relating to Tithe, Copyhold, Inclosure and Commons, Land Drainage, and certain other subjects during the year 1909 has recently been presented to Parliament. (Cd. 5,170, price 2½*d.*)

The Annual Report (Part I.) of the Intelligence Division has also been issued (Cd. 5,172, price 5½*d.*) Some information as to this Report is given on p. 220 of this issue.

MISCELLANEOUS NOTES.

Wheat Growing in Hungary.—The report on the trade of Hungary during 1908–9 by Mr. Esmé Howard, British Consul-General at Budapest (*Foreign Office Report, Annual Series, No.* 4429), states that Hungary seems to be gradually passing out of the class of wheat exporting countries into that of wheat importing ones. The harvest of 1909 was bad, the amount of wheat harvested being less than it has been for the last five years, while for the first time foreign wheat, mostly Roumanian and Russian, had to be imported in large quantities in order to keep the Hungarian flour mills at work. The greater part of this came from Roumania and Russia, but orders have also been placed in Argentina for wheat to be delivered in the course of the spring of 1910. This state of things has caused considerable anxiety in a country which was once one of the great wheat and flour exporting countries of Europe. The agricultural industry, has, however, passed through the ordeal satisfactorily, for the changing of crops, intensive culture, the good prices for export cattle, in which a growing and prosperous business is being carried on, have all helped to tide over these bad years.

Export of Fruit and Meat from Brazil.—The Acting Consul-General at Rio de Janeiro states that the National Society of Agriculture is taking active steps to promote the export of Brazilian fruit to Europe, and to secure suitable cold-storage accommodation for fruit on various lines of steamers. In addition, a decree has just been signed which empowers the Ministry of Agriculture to establish a new branch to deal with the establishment of model cold-storage and slaughter houses, and to take steps to furnish ships and trains with adequate and up-to-date cold-storage accommodation for transport. Labaratories are to be attached to the model slaughter houses which it is proposed to erect in the States of Minas, S. Paulo and Rio de Janeiro, and at suitable places in the North and South of the Republic. It is also proposed to grant awards, concessions, &c., to stimulate individual enterprise in this connection.

Paris Horse Show.—The Board of Agriculture and Fisheries are informed that the annual show of native stallions and mares, promoted by the French Ministry of Agriculture, will be held at Paris from 15th to 19th June. Only animals bred in France are eligible.

International Congress of Apiculture.—The fourth International Congress of Apiculture will be held at Brussels on September 25th and 26th next. The subscription for apicultural societies is fixed at twenty francs, and for members at five francs. Communications should be addressed to Monsieur Louis Genonceaux, Rue Grégoire-Bodart 8, Huy, Liége.

The subjects dealt with at the Congress will include both scientific and practical matters relating to bee-keeping and allied industries.

Notes on the Weather in May.

In the *first* week the general conditions were cold and very changeable. Except in Scotland E. and England N.E. warmth was deficient everywhere. Rainfall was "very heavy" in England E. and "heavy" in the Midland counties, England S.E. and N.W., and Scotland W.

In the *second* week similar conditions continued, rain, hail, and sleet alternating with periods of clear sky. Warmth was "moderate" or "deficient" in all districts, but sunshine "abundant," except in England S.E. and S.W. By the end of the week a general improvement had taken place.

By the *third* week the weather, though still changeable, had on the whole become far more seasonable. Warmth was "very unusual" everywhere except in England N.E., where it was "unusual," and Scotland E. "moderate." Rainfall was less than the normal in Scotland, but elsewhere there was an excess. Sunshine was generally less than the normal.

The *fourth* week was dry and often fine and bright. Warmth was "unusual" in every district (England S.W. "very unusual"), rainfall "light" or "very light," and sunshine "abundant" or "moderate."

During the twelve weeks of spring up to May 28th the number of accumulated day degrees of temperature above 42° F. has been in all districts of Great Britain greater than the average for the past twenty-five years, and the number below 42° F. has been less.

Notes on Crop Prospects Abroad. The following information has been published by the International Institute of Agriculture, Rome, in the *Bulletin of Agricultural Statistics* for May (No. 5):—

The (average) condition of the crops on May 1st is given in tabular form as follows, and represent the information received up to May 19th:—

CONDITION OF CROPS (100 = average.)

	Winter Cereals.			
	Wheat.	Rye.	Barley.	Oats.
Germany *	2·2	2·4	—	—
Austria *	2	2·3	2·3	2·1
Bulgaria...	118	116	117	116
Denmark	97	97	—	—
Hungary	130	120	130	125
Croatia and Slavonia ...	100	103	105	110
Luxemburg	91	98	93	—
Roumania	105	105	103	—
Sweden	100	100	—	—
Switzerland	100	95	104	—
United States	94·7	102·1	—	—
Canada—				
Ontario	95	—	—	—
Alberta	82	—	—	—
Tunis	100	—	99	100

* The report refers to April 15. Scale: 1 = very good; 2 = good; 3 = average; 4 = poor; 5 = very poor.

The following supplementary information is also given:—

Germany.—According to the German Council of Agriculture, the condition of wheat has somewhat improved and its development promises well. It is better than in April, 1909, and is also above the ten-year average. Rye, on the other hand, has somewhat deteriorated, and its condition is judged inferior to last month, although better than in April, 1909.

The spring seedings were almost all completed about the end of March; the last were finished in April. Owing to the chilly weather the crops have not sprouted much, and it is not yet possible to express an opinion on the condition. In many places bad weeds are reported among the oats.

Argentina (middle of April).—The final estimate of the production of maize is 87,570,000 cwt.

Austria.—According to reports in the middle of April, winter crops have wintered well, the weather being extremely mild. Rye only has suffered slightly from the snow. Complaints have been made in several districts of damage done by mice. The sowing of spring barley and oats was completed nearly everywhere in March; the sowing of maize is only finished in the southern districts, that is to say, in the plains.

The condition of winter cereals in Bosnia-Herzegovina is, in general, a good average; these crops have developed more especially during the last few days. The spring seedings, which had to be suspended owing to the wet weather, have only been completed in the plains; they are now being finished in the mountain districts. The seeds have sprouted well.

Bulgaria.—The conditions are, in general, excellent. Damage from insect pests is only reported to a very limited extent. The sowing of maize has taken place under very favourable conditions.

Chili.—A cable from the Government of Chili states that the metereological conditions under which the work of preparing the ground for the 1910–11 crops has been carried out have been favourable, and were good during the period of sowing and planting. On May 1st 25 per cent. of the work of planting had been completed; the season is backward as compared with that of last year.

Denmark.—In Jutland the crops suffered a little from the cold weather during the second half of April.

Hungary.—The weather has been favourable and damage by insects insignificant. The cold, damp weather which prevailed towards the end of April, and continued till May 6th, threatened damage to the crops; however, the fine weather which followed remedied the injury which had begun to be apparent. Wheat is almost everywhere healthy and vigorous. Some complaints as to rust have been received. Rye is fairly good. Barley promises a good harvest throughout the country, and oats are good everywhere; only here and there complaints as to weeds have been made. Spring wheat is satisfactory. Barley has suffered somewhat from the cold damp weather. Nevertheless, a good average harvest may be expected. The sowing of maize has been completed almost everywhere. It promises well, although the cold weather has not been favourable. The area sown shows an increase of 4·4 per cent. as compared with area sown in spring of 1909. Seventy per cent. of the seeding was completed by May 1st.

The conditions of the crops are good in Croatia and Slavonia.

Russia.—A report, dated May 12th, states that the mild temperature and occasional rains during April throughout Russia in Europe have had an excellent effect on the spring development of the crops. The condition of the autumn sown crops at the beginning of May (new style) were almost everywhere considered as quite satisfactory, while in the South-West and in Northern Caucasia conditions have been

reported as good. In these latter districts autumn wheat is exceptionally good. The sowing of spring wheat was completed towards the middle of April in the Caucasus, in several Governments of the black soil region, and in Poland. In other districts the sowing of spring wheat is now being completed. The condition of the spring wheat is everywhere satisfactory or good.

Sweden.—Very favourable weather has promoted rapid growth. Only in exceptional cases has rye seriously suffered on account of the snow. Owing to the unusually early spring, sowing was begun ten days earlier than usual, and is continuing under favourable weather conditions. Sowing is almost finished in the southern part of the country, and has begun all over the central districts.

Switzerland.—Generally speaking, the conditions of the crops are good; although wheat is still low and rye has suffered slightly.

Maize in South Africa.—The Commercial Intelligence Branch of the Board of Trade has received the following information from the Natal Commercial Agent in London relative to the South African maize crop :—

The latest report received from Durban of the prospects of the South African maize crop for the coming season states that the weather during April was particularly favourable, and the condition of the crops in the Transvaal, the Orange River Colony and Natal is much improved. As far as can be estimated, the reports indicate that the European crop in Natal and Orange River Colony will be about the same as last season, but that of the Transvaal is likely to show a considerable increase. It is not expected that any great quantity of the new crop will be shipped until July.

Russia.—According to a despatch, dated May 10th, from the British Consul-General at Odessa, the returns drawn up by the Central Statistical Committee in St. Petersburg for 1–14 April, 1910, and from later semi-official sources, it would now appear that the crops look quite hopeful in nearly all European Russia, and in many parts they are in better than average condition. The winter crops are fully good in the southern and south-western parts of Russia, and fairly good in the more central parts. With a favourable May the winter crops should prove above the average. The spring crops, as far as can be judged, look very well and fairly even.

Germany.—According to the Report of the Imperial Statistical Bureau, referring to the middle of May, the condition of the crops was as follows :—Winter wheat, 2·3; spring wheat, 2·5; winter rye, 2·6; spring rye, 2·4; barley, 2·4; oats, 2·5 (1 = very good; 2 = good; 3 = medium (average); 4 = small). Winter cereals made relatively little progress during the month. No general report is available for potatoes, as they were not sufficiently forward in most districts.

France.—The *Journal Officiel* of 2nd June gives the following official estimates of the area under crops on 1st May last :—Winter wheat, 15,517,000 acres; spring wheat, 614,400 acres; winter barley, 358,300 acres; spring barley, 1,487,100 acres; winter oats, 1,977,500 acres; spring oats, 7,728,100 acres; rye, 3,066,900 acres; mixed corn, 340,600 acres. With respect to the condition of the crops, winter wheat is stated to be "good" in twenty-six departments, representing 3,951,000 acres, "fairly good" in fifty-six departments, representing 11,023,000 acres, and "average" in five departments, with 543,000 acres. Spring

wheat is "good" in seventeen departments (265,000 acres), "fairly good" in thirty-five departments (270,000 acres), and "average" in two departments (79,000 acres). Barley, oats, rye, and mixed corn are "good" or "fairly good" in the great majority of the departments.

Austria.—According to the official report the condition of the crops at mid-May was as follows:—Wheat, 1·9; rye, 2·5; barley, 2·2; oats, 2·3; maize, 2·2; potatoes, 2·4. The condition of the crops at mid-April is given in the table above furnished by the International Agricultural Institute (*Dornbusch,* 27th May).

India.—The final official estimate gives the total production of wheat in 1910 as 9,560,000 tons, compared with 7,580,000 tons in 1909, and an average for the five years 1902–6 of 7,845,200 tons. The yield of linseed is estimated at 428,000 tons, against 289,000 tons in 1909, and a five years' average of 445,800 tons. (*Beerbohm,* 27th May.)

United States.—The Crop Reporting Board of the Department of Agriculture state that the average condition of winter wheat on June 1st was 80·0, as compared with 82·1 on May 1st, 1910, 80·7 on June 1st, 1909, and 81·9 the mean of the averages of the past ten years. Preliminary returns put the acreage of spring wheat sown at 19,742,000 acres, an increase of 7·3 per cent., compared with the acreage sown last year. The average condition of spring wheat on June 1st was 92·8, compared with 95·2 on June 1st, 1909, and a ten-year average of 93·0. The total reported area of oats is 34,380,000 acres, an increase of 3·5 per cent. over last year. The condition on June 1st was 91·0, against 88·7 on June 1st, 1909, and a ten-year average of 88·4. The acreage of barley is reported to be 0·7 per cent. larger than last year, and the condition on June 1st was 89·6, compared with 90·6 last year, and a ten-year average of 91·3.

Agricultural Labour in England during May.

The Board of Agriculture and Fisheries have been furnished by the Board of Trade with the following report, based on returns from correspondents in various districts, on the demand for agricultural labour in May.

Agricultural employment was generally regular, though a few day labourers lost time through rain in the early part of May. There was a better demand for such men than in the previous month on account of hoeing, potato planting, and other seasonal work, but the supply was sufficient in most districts covered by the reports.

Northern Counties.—Employment was generally regular in these counties, with the supply of labour about equalled by the demand. Some reductions in wages of men servants were reported at the Whitsuntide hirings in *Cumberland* and *North Lancashire.* At the May hirings in *Yorkshire* there was, on the whole, little change in wages compared with the previous year.

Midland Counties.—Employment was regular, except in the case of a few day labourers, who lost time through rain. This class of labour was usually in good demand for such work as preparing the land for root crops, planting potatoes, and hoeing corn, and mention of a surplus in the supply was exceptional in the reports.

Eastern Counties.—Some day labourers lost a little time through rain in the early part of the month; otherwise these men were in good

and constant demand, principally for hoeing, which several correspondents reported as backward, and for weeding corn. The supply of labour was usually sufficient, but some scarcity of day men was reported in the Wisbech (*Cambridgeshire*) Union, the Lincoln and Sleaford (*Lincolnshire*) Unions, the Docking (*Norfolk*) Union, and in the Braintree (*Essex*) Union. At the May hirings in *Lincolnshire* little change in wages on the whole was reported, but in some cases men accepted rather lower wages than a year ago.

Southern and South-Western Counties.—Employment was generally regular in these Counties, though a few correspondents mentioned some slight interruption from rain to the employment of day labourers. Hoeing, carting and spreading manure, potato planting, weeding, hedging, &c., caused a fair demand for this class of labour, which was invariably met by the supply.

THE CORN MARKETS IN MAY.

C. KAINS-JACKSON.

A decline in prices in May was not expected, for the reductions before the end of April had been judged sufficient to bring seller and buyer together. As May progressed the farmer, while delivering no excessive quantity of old wheat, reduced his supplies of old barley and oats so materially that at several leading exchanges averages could not be struck. Thus the weakness of business must be assigned wholly to the influence of imports. Grain from the Colonies and abroad had been held with some firmness up to Easter, but the large new wheat crop reported from India first caused spot holders to reconsider their views. The state of trade from May 1st up to Whitsuntide could scarcely be called healthy, but it was only in the last fortnight of the month that the rush to secure a prompt market for newly arrived cargoes caused a serious fall in prices.

Wheat.—British wheat is about eighteenpence per quarter cheaper on the month, but supplies have not been excessive, and farmers have rather modified their requirements out of sympathy with the far heavier fall in imported wheat than under any direct pressure to sell. The decline in imported wheat is difficult to average, but may perhaps be put at a minimum of 3*s.* per qr. On the last day of April new Indian wheat was on sale off stands at 39*s.* per 496 lb.; on the last day of May 33*s.* was accepted. This represents the extreme measure of decline, and has been induced by the large surplus. Official figures available on the 30th, and materially influencing Mark Lane, gave the yield at 9,535,000 tons against 7,585,000 tons for the previous season. As the 7,585,000-ton yield exceeded local needs and admitted of some exports, it was argued that an extra two million tons would be available in the course of the next twelve months. The experience of Indian wheat shipments in the past, however, hardly warrants the corollary that the extra two million tons will be shipped. Australian wheat, with over two million quarters on passage, has fallen from 40*s.* to 35*s.* 6*d.*, Durum has fallen from 38*s.* to 33*s.* 6*d.*, and Odessa Ghirka from 38*s.* 6*d.* to 32*s.* 6*d.* Australian, despite an almost unprecedentedly

large quantity in sight, has been held with more determination than some other sorts, of which the supply in evidence has been greatly less.

The total of all descriptions on passage declined during the month from 4,150,000 qrs. to 3,950,000 qrs., but on June 1st, 1909, only 2,878,000 qrs. were in sight. Shipments for May were 1,003,000 qrs. from North America, 904,000 qrs. from South America, 299,000 qrs. from India, 1,863,000 qrs. from Russia, 105,000 qrs. from Europe S.E., and 417,000 qrs. from Australasia. Stocks of imported wheat in granary are estimated at 565,000 qrs. more than at this date last season. The excess is not considerable; it is to the large increase in the prospective supply that the depression of the foreign wheat market must principally be ascribed. The second cause is the promise of growing crops, and at the end of May many operators had already convinced themselves that wheat would be plentiful in the new cereal year which does not begin before September 1st next.

Flour.—On the 30th the London Flour Millers' Association reduced credit and delivery prices to 31*s.* 6*d.* for Town Whites, and to 28*s.* 6*d.* for Town Households. Iron Duke was lowered to 25*s.* 6*d.* by the importers of this popular American type. America in May shipped only 247,000 sacks, and has not consented easily to the declining tendencies at Mark Lane. The supply on passage has fallen on the month from 180,000 to 158,000 sacks.

Barley.—The fall in British samples amounts to about eighteenpence per qr., but there has been hardly any 448 lb. barley on offer, and the poorer sorts of home-grown have fallen in competition with cheap grinding barley from Russia, Persia, and India. Where quality falls below a certain standard the foreign supplies tell severely on value, but, on the other hand, foreign production seldom affects the value of barley which reaches 424 lb. in natural weight. May shipments were 1,511,000 qrs. from Russia, 116,000 qrs. from Europe S.E., and 19,000 qrs. from North America. The heavy offers of Russian have reduced the selling price to 18*s.* per 400 lb., but the supply on passage has fallen from 350,000 to 300,000 qrs.

Oats.—The fall in British oats is trivial, and can scarcely be said to extend to 336 lb. descriptions. Imported oats at the end of the month were offered at low prices; 15*s.* to 15*s.* 6*d.* per 304 lb. for Russian, 13*s.* to 13*s.* 9*d.* per 304 lb. for La Plata. The Russian oats mostly attain about 304 lb. natural weight, but the bulk of the Argentine is only 288 lb. to the quarter, the remaining 16 lb. being "made up" to the buyer. Shipments for May were 120,000 qrs. from North America, 224,000 qrs. from South America, 455,000 qrs. from Russia, and 80,000 qrs. from Europe S.E. The supply on passage has fallen from 460,000 qrs. to 410,000 qrs., but is still considerable.

Maize.—Prices show little change. American is far from plentiful, and 25*s.* is asked where a month ago 24*s.* 3*d.* was accepted. Argentine then at 26*s.* 9*d.* is now at 26*s.* 6*d.*, and Russian round corn at 25*s.* 6*d.* Indian and Burmese sell steadily at 25*s.* per qr. Forward offers for July delivery are materially lower, however, and it is simply a spot shortness of supply which has to be chronicled. Shipments were 154,000 qrs. from North America, 192,000 qrs. from South America, 170,000 qrs. from Russia, and 442,000 qrs. from Europe S.E., which ships a like quality to Russian. The quantity on passage has

risen from 180,000 to 435,000 qrs., and about 1s. per qr. fall before June is out is generally anticipated.

Oilseeds.—The fall in prices which has marked the past month has been welcome to all interested in the fattening of stock. May closed with sound linseed obtainable at 56*s.* per 416 lb., with Indian brown rapeseed of the new crop offered at 37*s.* per 416 lb., and with good Egyptian cottonseed down to £9 per ton to cash buyers. There were 288,000 qrs. of linseed, 36,000 qrs. of rapeseed, and 82,000 tons of cottonseed on passage. The May shipments of linseed were 260,000 qrs. from Argentina, and 484,000 qrs. from India.

Oilcake.—Prices have followed somewhat reluctantly the downward tendencies of the raw material. On the 31st London-made linseed cake was at £8 10*s.*, but the best cottonseed cake was held for £6 11*s.* 3*d.* Soy bean cake has fallen from six guineas to six pounds per ton.

Various Feeding Stuffs.—Beet sugar has advanced to 14*s.* 9*d.* per cwt. for current (June) delivery, but is offered at 12*s.* for November shipment from Germany. Feeding rice at 7*s.* 9*d.* per cwt. on the 31st showed absolute immobility on the month. Sales are fair and steady. Canary seed at 38*s.* per 464 lb. sells well. For many years its price was about 60*s.*, which excluded it from agricultural use, but nowadays any quotation below 40*s.* promptly creates a demand. Other sound staples which at the close of the month were in more or less request were dari at 25*s.* per 480 lb., rye at 26*s.* per 480 lb., brown mustard seed at 72*s.* per qr., and split lentils at 10*s.* per cental.

THE LIVE AND DEAD MEAT TRADE IN MAY.

A. T. MATTHEWS.

Fat Cattle.—The markets, both in London and the provinces, continued to be well supplied with cattle, the good quality and finish of which have been quite a feature of the spring season. The position of sellers was strong throughout, prices steadily advancing, and the average price of Shorthorns in about 23 of the leading English markets was 8*s.* 11*d.* and 8*s.* 1*d.* per stone for first and second quality. This was an advance of 5*d.* and 4*d.* per stone respectively on the April averages. Compared with the values current at this time last year, the above are higher by nearly 1*d.* per lb., or about £3 on a bullock of average weight. Many of the country markets were dearer than that of London, reversing, in this respect, the conditions prevailing in April. Bristol, for some reason which does not clearly appear, was the dearest English market, and prime Shorthorns were there reported at 10*s.* per stone in the last week, the general average of the country that week being 9*s.* 1*d.*, and that of Norwich only 8*s.* 9*d.* Such wide variations point to the advisability of the close study of the markets by farmers, and selecting them accordingly for the consignment of stock. As regards the comparative prices realised by different breeds, it may be interesting to note that the average for first quality Herefords during May was 9*s.* per stone, that of Polled Scots was about the same, while Devons only fetched 8*s.* 9*d.* This, of course, was owing to the time of year not being favourable to the Devon breed compared with others.

Veal Calves.—The trade in fat calves was of a very even character,

the averages varying very slightly from week to week, the last being the lowest. The average for the month was 8¾*d.* for first and 7*d.* for second quality, a reduction of ¼*d.* and ½*d.* per lb. respectively on April prices.

Fat Sheep.—The following refers to clipped sheep only, those sold in the wool having been comparatively few. There were complaints in some markets of poorly finished sheep, but on the whole the condition of the tegs has been better than might have been expected after such an unfavourable winter, while the numbers coming out have been about normal. The demand generally was good, and prices were somewhat higher than they were in April, with a decided upward tendency, during the last week, in London and some other important markets. Prime Downs of about 64 lb. weight averaged 8*d.* per lb.; second quality, or those of 80 lb. and upwards, 7¼*d.*; and ewes 6*d.* Longwools averaged 7½*d.*, 6¾*d.*, and 5½*d.* for first, second, and third quality. The trade in Scotland was also very firm throughout, cross-breds and Cheviots making up to 11*d.* per lb. in the wool at Glasgow, Edinburgh, and Castle Douglas.

Fat Lambs.—The trade in lambs was fairly good generally, but the averages for the month of 11¼*d.* and 10*d.* per lb. for first and second quality were ¾*d.* per lb. lower than those of April. The trade was, relatively, no worse, but naturally, as the season advances, lambs increase largely in weight and realise less per lb. The great variation in values at different markets noted in April was again conspicuous. It is a remarkable fact that London has been, throughout the season, one of the worst markets for lambs.

Fat Pigs.—Bacon pigs continued to appear at about 30 English and Scotch markets in quotable numbers, and the trade was remarkably sharp for the time of year. Prices, however, were slightly lower than in the previous month, the average for first and second quality being 7*s.* 10*d.* and 7*s.* 2*d.* per stone.

Carcass Beef—British.—The value of British beef in the dead markets has been steady, with a gradually hardening tendency, prices throughout keeping in fair proportion to those in the live stock markets, with very little difference between those ruling in London and in the great Midland towns. The highest price touched in Smithfield market was about 6¾*d.* per lb. for Scotch short sides at the close of the month, and about 6¾*d.* for English, the average prices for the month being 62*s.* per cwt. for first quality Scotch, and 60*s.* for English.

Port Killed Beef.—This class of beef has continued remarkably dear in proportion to British. Till the last week it stood on a level with English, but the latest London quotations placed it ⅜*d.* per lb. higher, and ⅛*d.* above the best Scotch long sides. This unusual occurrence was partly owing to the hot weather, which affected the condition of meat after long distance railway transit.

Chilled Beef.—With the exception of the second week, when trade was bad for Argentine quarters, chilled beef sold well, and became very dear at the end of the month. The best hindquarters of Argentine averaged 5½*d.*, and American States 7*d.* per lb.

Frozen Beef.—There was a better inquiry for "hard" beef than in April, and prices advanced, till, at the close of the month, best hindquarters fetched 5*d.* per lb.

Carcass Mutton—Fresh Killed.—The trade was quiet with very even prices till the last week, when Scotch fetched $8\frac{1}{2}d.$ and English $7\frac{1}{2}d.$ per lb. for best quality, the monthly averages being $8d.$ and $7\frac{1}{8}d.$ Dutch mutton was selling at $6\frac{1}{2}d.$ to $7d.$ per lb.

Frozen Mutton.—This article was in unlimited supply, and prices ruled lower than in April by about $\frac{1}{4}d.$ per lb. The best New Zealand was procurable at $4d.$ per lb. at any time in the Central Market.

Carcass Lamb.—The demand for British lamb in London was exceedingly poor, and prices for the best never exceeded $9\frac{1}{2}d.$ per lb. The best New Zealand sold more freely at about $5\frac{1}{2}$d.

Veal.—Supplies were large, and prices ranged a little below those of April. Best English averaged $7\frac{1}{8}d.$ and Dutch $7\frac{1}{4}d.$ per lb.

Pork.—Although a smaller business was doing, trade was good for the time of year, and small English pigs averaged $7\frac{1}{2}d.$ and Dutch $7\frac{1}{4}d.$ per lb.

THE PROVISION TRADE IN MAY.

HEDLEY STEVENS.

Bacon.—Prices have fluctuated considerably during the month, being at their lowest point during the week ending May 7th, when, on account of the approaching holidays and some accumulation of Continental and other lightly cured meats which require a quick market, prices were reduced to bring on the consumption. By the end of the month quotations had generally advanced on all descriptions of bacon and hams. This advance was mainly brought about by the continued short supplies from the United States and Canada, these being about half what they were for the same period last year, when they were much below the average.

Advices from both the United States and Canada point to still further reductions in the quantities to be shipped in the near future, as, though we are on an exceedingly high basis of prices on spot, we are several shillings per cwt. under cost of production. During the past month a further record was established, when, for one week, only 2,300 boxes of bacon shipped to Liverpool. Importers are afraid to contract for shipment at the prices demanded, and, in consequence, most of the arrivals are composed of parcels consigned by a few leading packers for sale on the English markets in order to keep their brands before the trade.

American lard shows a drop of about 4*s.* per cwt. on the month, and the demand was very small.

English pigs show little change in price, although the quantities offered on all markets continue small.

Both English and Irish bacon was in good demand, on account of the shortage in imports.

Cheese.—The consumptive demand throughout the month has been very disappointing, and prices have favoured buyers, there being a reduction each week. This has been brought about by the continued large arrivals from New Zealand, which, at the prices asked, say, from 3*s.* to 5*s.* under best old Canadians, are considered better value. This has had the same effect on the new Canadian makes, buyers refusing

to handle them at around the same price as New Zealands, and in consequence by the end of the month there was an accumulation of new cheese in most markets, resulting in importers being very indifferent about committing themselves to further purchases in Canada, although prices were down to 52*s.* to 53*s.*, per cwt. c.i.f., or about 5*s.* to 6*s.* per cwt. under those current at the same time last year. The latest advices from Canada report that the May make was not quite so large as that of last year, but the pasturage conditions are good in most sections, also that the cows are in good condition, so the quantity should quickly recover. Since the opening of navigation of the St. Lawrence, the total shipments to this country are about the same as last year.

In the United States finest full cream cheeses were making around 68*s.*, and skims 54*s.* to 58*s.* per cwt.

At the end of the month the estimated stocks of Canadian cheese at the three principal distributing centres (London, Liverpool, and Bristol) were 99,000 boxes, against 63,000 boxes last year, and 88,000 two years ago.

English cheese was in fair demand, and by the end of the month much improved prices were realised, chiefly on account of improved quality.

Butter.—The demand has been slow throughout the month. Arrivals from Australia and New Zealand have continued large, and with improved conditions of home pasturage, prices have favoured buyers on all markets. This has made buyers very timid, resulting in hand-to-mouth trading.

Advices from Canada report a steady market, with a good home demand, and Vancouver still taking supplies from Montreal. Prices continue above an export basis, so there are no shipments for the month. The pastures are in excellent condition.

Prices continue abnormally high in the United States, as much as 136*s.* to 138*s.* per cwt. being made for best fresh selections.

Arrivals from Siberia have been fair, but the quality somewhat irregular.

Irish butter was marketed much more freely, and the quality being very satisfactory, there was a good demand for best creameries.

Towards the end of the month, arrivals from Denmark showed a falling off, as tinning operations were in full swing.

Eggs.—Prices have mostly been in favour of buyers during the month. Arrivals from the Continent have been fair, and shipments from Denmark increased at the end of the month, on account of the demand for pickling purposes having fallen off. There was a moderate demand for English and Irish.

THE FRUIT TRADE IN THE METROPOLIS.

W. W. GLENNY.

The markets of London are amply supplied with immense quantities of fruit from home and abroad, not merely for consumption in the immediate vicinity, but as a distributing centre for the provinces.

Pineapples.—The cultivation of pineapples for sale has almost been

abandoned in this country, but we receive large consignments from Teneriffe, which are sold at Covent Garden during many months of the year. The present price is about 3*s.* to 5*s.* each, which is rather higher than usual.

Grapes.—Last Michaelmas, glass-house grapes realised exceedingly low prices, and many growers talked of giving up their cultivation. When fine Alicante and Black Hamburgh grapes only realise from 4*d.* to 6*d.* per lb. the trade must certainly be unremunerative. Muscats were worth rather more, from 1*s.* 6*d.* to 4*s.*, but there is only a limited demand at this price. Competition from Belgium and Spain is severe, and threatens to ruin the grape trade in this country. Large quantities of Almeria grapes are landed close to London Bridge, and consigned to auctioneers at the Monument, where they are disposed of to dealers, fruiterers and costermongers at low prices. At present the figures for selected parcels are about 9*s.* to 12*s.* per dozen pounds, but in the winter season they are extremely cheap, and it is at that time that they compete severely with the home-grown supply of a better class. Just now new Black Hamburghs of home culture are arriving, and the price rules between 2*s.* 6*d.* and 3*s.* 6*d.* per lb.

Tomatoes.—Tomatoes come now from Worthing and many other glass-fields, and also from the Channel Islands and the Canaries. Values vary according to the district where they originate; British stand first from 4*s.* 6*d.* to 6*s.* 6*d.*, Guernseys come next at from 4*s.* to 6*s.* per dozen pounds, while Canaries in boxes are cheap.

Gooseberries.—Gooseberries appear on the market at Whitsun, and gradually supersede rhubarb. The earliest receipts come from Kent and Worcestershire, and are followed by consignments from Middlesex and the surrounding districts. The current price is 4*s.* to 4*s.* 6*d.* a half-bushel, estimated to contain 24 lb. Where there is a heavy crop this price should be remunerative.

Strawberries.—Strawberries have suffered immensely this spring; they are now in bloom, but the foliage is meagre, and with such scarcity of leafage a full crop can hardly be predicted. Last year there was a heavy yield, but this was counterbalanced by the unfavourable weather. Never were so many tons of strawberries left mouldy in the open, some picked, some left on the bine ungathered; while thousands of baskets were sent from the Southampton district, which on arrival in London were nearly worthless. Strawberries now arriving are raised under glass, and fetch from 6*d.* to 3*s.* per lb., according to size and colour. They will rapidly become cheaper when the first parcels grown in the open air begin to arrive.

Cucumbers.—Cucumbers fluctuate considerably according to demand and supply. Early in the year the demand was small, but the quantity ready for table was smaller still, so that fine, well-shaped cucumbers realised 10*s.* to 12*s.* per doz.; these favourable prices were maintained for about a month, and then dropped gradually, until now about 2*s.* to 2*s.* 6*d.* a dozen is an average price. Large quantities are received from Holland, and this tends to depress prices. In Bedfordshire and other counties, a limited acreage of Ridge cucumbers is produced in autumn; these require shelter early in their career, and rows of rye are sown in the previous November to form a temporary hedge, just strong enough to break the wind when plants are tender. In a

moderately warm season these out-door cucumbers are extremely useful for mixed pickles. When £4 a ton can be obtained for a fair sample of these, after taking away a few of the best-shaped specimens for sale separately, they may be considered a remunerative crop.

Marrows.—Marrows at this season are grown under glass. They arrive at market in white-handled baskets, and are worth 4*s.* to 6*s.* per dozen first hand. At these prices they are profitable, but when cultivated widely in the field, they quickly become a drug in the market. Unlike cucumbers, they are of little value except for the purpose for which they are produced, and when large marrows touch the level of 1*s.* 6*d.* to 2*s.* 6*d.* per tally, or five dozen, they are not worth carriage.

Apples.—The apple is the most important fruit that ripens perfectly in Great Britain, when both its culinary and its table value are taken into account, but, unfortunately, apple orchards have been rather neglected in this country. Considering the general demand for this fruit, it is surprising that even those who have suitable situations and facilities for raising them, have not taken their share in providing our markets with choice apples. The result is that other countries have sought to meet the needs of our population, and a continuous stream of apples arrives from abroad during many months of the year. A perfect system of cold storage enables exporters to send fruit, not only across the Atlantic, but also from Australia.

The secret of success with the apples sent from Nova Scotia, California, Oregon, and from our own Colonies, is the superior method of grading and packing. Growers in England, on the other hand, often send the fruit to market as it is gathered, small and large together, or, worse still, add the windfalls which they pick up off the ground. These bruised, worm-eaten, defective apples deteriorate the sample and lower the price of the whole. Windfalls should be sold at home at a nominal price or given to pigs, and should never be mixed with better fruit, as they only add to the cost of transit, market and commission charges, without themselves yielding any return. Retailers often prefer barrel or box apples from abroad to those grown at home, because the delivery is so much better. The box or case apples are each packed separately in paper, and thus reach the consumer in prime condition, with extremely little waste. Oregon apples have fetched capital prices during January, February and March this year, the figures ranging from 12*s.* to 16*s.* per case of 40 lb. net weight, or, roughly speaking, about 4*d.* per lb. wholesale; Californian apples hardly come up to the Oregon supply, the price for the corresponding period being from 7*s.* 6*d.* to 10*s.* per case.

At this time of year the markets are supplied with apples from British Colonies, South Australia and Tasmania taking the lead. Prices vary according to variety, Cox's Orange Pippin fetching 11*s.* to 14*s.* per case; Ribstons, Munro's Favourite, Cleopatra, Jonathan, are all of first-rate quality and range from 8*s.* 6*d.* to 10*s.* 6*d.* or 11*s.* per case. Sturmer and Scarlet Pearmain, and other kinds, make rather less, say 8*s.* to 10*s.* per case.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and SCOTLAND in the Month of May, 1910.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	England. First Quality.	England. Second Quality.	Scotland. First Quality.	Scotland. Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per cwt.†	per cwt.†
Cattle:—	s. d.	s. d.	s. d.	s. d.
Polled Scots	9 1	8 8	41 6	38 2
Herefords	9 0	8 4	—	—
Shorthorns	8 11	8 1	40 7	37 4
Devons	8 9	8 1	—	—
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	$8\frac{3}{4}$	$7\frac{3}{4}$	$9\frac{1}{4}$	$6\frac{3}{4}$
Sheep:—				
Downs	$8\frac{1}{4}$	$7\frac{1}{4}$	—	—
Longwools	$7\frac{3}{4}$	7	—	—
Cheviots	$9\frac{1}{2}$	$8\frac{1}{4}$	10	$8\frac{1}{2}$
Blackfaced	9	8	$9\frac{1}{4}$	8
Cross-breds	$8\frac{1}{4}$	$7\frac{1}{4}$	$10\frac{1}{4}$	$8\frac{3}{4}$
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs:—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	7 10	7 4	7 11	6 10
Porkers	8 3	7 9	8 1	7 3
LEAN STOCK:—	per head.	per head.	per head.	per head.
Milking Cows:—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	21 6	17 17	22 11	18 4
,, —Calvers... ...	21 1	18 0	19 9	17 4
Other Breeds—In Milk ...	17 14	15 6	18 10	16 2
,, —Calvers ...	18 0	13 2	19 18	16 6
Calves for Rearing	2 8	1 17	2 17	2 0
Store Cattle:—				
Shorthorns—Yearlings ...	10 12	8 18	11 14	8 18
,, —Two-year-olds...	15 2	13 4	15 16	13 11
,, —Three-year-olds	18 10	16 2	18 17	15 10
Polled Scots—Two-year-olds	—	—	17 4	14 14
Herefords— ,,	15 5	13 12	—	—
Devons— ,,	14 13	13 2	—	—
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	43 5	38 5	—	—
Scotch Cross-breds ...	—	—	35 11	29 5
Store Pigs:—				
Under 4 months	32 1	25 9	28 2	21 1

* Estimated carcase weight.

† Live weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND and SCOTLAND in the Month of May, 1910.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Quality.	Birmingham.	Liverpool.	London.	Manchester.	Edinburgh.	Glasgow.
		per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.
BEEF :—							
English	1st	60 6	61 0	60 0	61 0	58 6*	60 6*
	2nd	56 6	57 0	58 6	57 6	54 0*	56 6*
Cow and Bull ...	1st	54 0	50 0	50 6	52 0	51 6	53 0
	2nd	49 6	45 0	46 0	47 0	45 0	43 6
U.S.A. and Canadian :—							
Port Killed ...	1st	—	61 0	61 0	60 6	—	57 0
	2nd	—	57 6	57 6	58 6	—	55 0
Argentine Frozen—							
Hind Quarters...	1st	44 0	43 0	43 0	43 0	44 6	40 0
Fore ,, ...	1st	39 0	38 6	37 6	38 6	39 6	35 6
Argentine Chilled—							
Hind Quarters...	1st	52 0	50 6	51 6	52 0	52 6	50 0
Fore ,, ...	1st	41 0	39 6	39 6	40 0	41 0	41 0
American Chilled—							
Hind Quarters—	1st	—	64 0	65 6	64 0	—	—
Fore ,, ...	1st	—	45 0	45 0	45 0	—	—
VEAL :—							
British	1st	65 6	74 6	66 6	73 0	—	—
	2nd	56 6	65 6	62 0	65 6	—	—
Foreign	1st	—	—	67 6	—	69 6	—
MUTTON :—							
Scotch	1st	—	83 0	74 0	81 6	72 0	81 0
	2nd	—	77 0	70 6	77 0	63 6	71 6
English	1st	68 0	75 0	66 6	76 0	—	—
	2nd	56 0	69 0	63 0	70 6	—	—
Argentine Frozen ...	1st	34 6	34 6	34 0	34 6	34 6	35 0
Australian ,, ...	1st	33 0	32 0	32 0	32 0	—	33 0
New Zealand ,, ...	1st	—	—	35 6	—	—	—
LAMB :—							
British	1st	88 6	90 0	88 0	92 0	83 0	107 6
	2nd	83 6	80 0	81 6	87 6	74 6	93 6
New Zealand ...	1st	53 0	50 0	51 0	50 6	55 0	54 0
Australian	1st	48 0	46 6	48 6	46 6	—	49 0
Argentine	1st	47 0	46 6	47 0	48 0	51 6	49 0
PORK :—							
British	1st	70 0	65 6	70 6	65 6	66 6	69 0
	2nd	64 6	59 6	64 0	60 6	59 0	64 0
Foreign	1st	—	—	67 6	—	—	—

* Scotch.

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1908, 1909 and 1910.

Weeks ended (*in* 1910)	Wheat.			Barley.			Oats.		
	1908.	1909.	1910.	1908.	1909.	1910.	1908.	1909.	1910.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. a.*
Jan. 1 ...	35 1	32 0	33 3	26 9	26 7	25 1	18 4	17 4	17 4
,, 8 ...	35 2	32 9	33 6	26 9	26 11	24 11	18 3	17 5	17 2
,, 15 ...	35 5	32 8	33 8	27 1	27 1	24 11	18 5	17 5	17 7
,, 22 ...	35 6	33 2	33 9	26 11	27 3	24 11	18 5	17 8	17 6
,, 29 ...	35 0	33 0	33 6	26 11	27 6	25 0	18 4	17 9	17 4
Feb. 5 ...	34 3	33 4	33 7	26 9	27 7	24 10	18 3	17 10	17 7
,, 12 ..	33 1	33 8	33 4	26 9	27 8	24 9	18 0	17 11	17 11
,, 19 ...	32 6	34 1	33 0	26 5	27 11	24 6	17 11	18 0	18 0
,, 26 ...	30 11	34 5	32 7	26 3	28 0	24 2	17 8	18 0	17 10
Mar. 5 ...	30 5	34 10	32 7	26 1	27 11	24 6	17 8	18 2	18 1
,, 12 ...	31 3	35 8	32 6	26 0	28 4	24 1	17 10	18 2	18 0
,, 19 ...	31 7	35 9	32 6	26 2	28 0	23 6	17 11	18 5	18 0
,, 26 ...	31 4	36 0	32 9	25 10	28 0	23 7	17 10	18 6	17 11
Apl. 2 ...	31 3	36 5	33 0	25 5	27 10	23 8	17 9	18 8	18 0
,, 9	31 2	37 4	33 6	25 10	28 0	23 1	17 7	18 10	17 11
,, 16 ...	30 11	38 7	33 7	26 1	27 8	23 5	17 7	19 2	18 3
,, 23 ...	30 10	41 4	33 7	25 5	28 2	23 0	17 9	19 9	18 3
,, 30 ...	31 6	42 5	33 0	25 8	27 10	22 10	18 0	20 0	18 3
May 7 ...	32 4	40 9	32 6	25 5	27 7	22 7	18 4	20 3	18 2
,, 14 ...	33 1	41 6	32 1	24 9	27 3	22 0	18 7	20 6	18 1
,, 21 ...	33 8	42 8	31 10	25 9	27 0	21 8	18 10	20 11	17 8
,, 28 ...	33 5	42 6	31 3	24 6	26 3	21 4	18 8	21 0	17 10
June 4 ...	33 1	43 1	30 2	25 10	25 7	21 8	18 4	21 3	17 10
,, 11 ...	32 7	42 11	29 1	24 5	26 10	20 9	18 4	21 4	17 10
,, 18 ...	32 0	42 7		24 2	26 10		18 5	21 6	
,, 25 ...	31 5	42 8		24 0	27 2		18 7	21 7	
July 2 ...	30 11	42 9		23 11	27 2		18 7	21 9	
,, 9 ...	30 5	43 0		24 4	26 4		18 5	21 8	
,, 16 ...	30 7	43 3		23 1	26 10		18 5	21 9	
,, 23 ...	31 5	44 0		26 5	27 4		18 6	22 5	
,, 30 ...	31 10	43 5		24 4	24 6		18 7	22 2	
Aug. 6 ..	31 6	44 9		23 1	27 4		18 9	22 11	
,, 13 ...	31 6	44 9		23 10	24 9		18 1	21 8	
,, 20 ...	31 2	41 6		24 5	23 11		17 10	19 8	
,, 27 ...	30 10	38 5		24 5	24 7		17 1	19 4	
Sept. 3 ...	30 10	37 2		25 5	26 3		17 3	19 6	
,, 10 ...	31 5	34 11		25 11	26 1		17 6	18 5	
,, 17 ...	31 7	33 6		26 0	26 5		17 3	17 9	
,, 24 ...	31 5	32 9		26 8	26 8		17 2	17 7	
Oct. 1 ...	31 7	32 2		26 11	26 9		17 2	17 2	
,, 8 ...	31 5	31 8		27 5	26 9		17 0	17 0	
,, 15 ...	31 2	31 4		27 6	27 0		17 0	17 0	
,, 22 ...	30 11	31 8		27 5	27 7		16 11	16 11	
,, 29 ...	30 8	31 10		27 5	27 9		16 11	17 0	
Nov. 5 ...	30 11	32 5		27 6	27 9		17 0	17 0	
,, 12 ...	31 2	32 5		27 4	27 7		17 0	17 1	
,, 19 ...	31 10	32 7		27 3	27 0		17 3	17 4	
,, 26 ...	32 3	33 0		27 2	26 8		17 5	17 3	
Dec. 3 ...	32 7	33 3		27 2	26 1		17 4	17 4	
,, 10 ...	32 8	33 3		27 0	25 7		17 4	17 3	
,, 17 ...	32 9	33 2		26 9	25 3		17 3	17 4	
,, 24 ..	32 2	33 1		26 8	25 2		17 2	17 4	

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lbs.; Barley, 50 lbs.; Oats, 39 lbs. per Imperial Bushel.

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE, BELGIUM, and GERMANY, and at PARIS, BERLIN, and BRESLAU.

—		WHEAT.		BARLEY.		OATS.	
		1909.	1910.	1909.	1910.	1909.	1910.
		s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
France :	April	40 1	42 2	26 9	25 11	22 0	21 10
	May	42 5	42 1	27 4	25 9	23 4	21 10
Paris :	April	40 6	43 0	23 3	24 8	20 11	22 1
	May	45 4	44 0	23 3	24 8	24 0	22 3
Belgium :	March	37 1	35 10	26 4	23 10	20 3	19 8
	April	40 6	—	26 8	—	22 4	—
Germany :	March	47 8	45 7	30 8	25 9	23 11	21 3
	April	50 3	46 7	31 7	25 9	25 1	21 0
Berlin :	March	49 5	48 0	—	—	24 9	22 5
	April	51 11	48 3	—	—	25 0	21 11
Breslau :	March	44 3	44 8	31 6 (brewing) 26 0 (other)	25 4 (brewing) 24 2 (other)	22 5	19 11
Breslau :	April	47 11	44 10	32 6 (brewing) 26 0 (other)	25 4 (brewing) 24 2 (other)	23 8	20 0

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique* ; the Belgian quotations are the official monthly averages published in the *Moniteur Belge* ; the German quotations are taken from the *Deutscher Reichsanzeiger*, the prices for the German Empire representing the average of the prices at a number of markets.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of May, 1909 and 1910.

—	WHEAT.		BARLEY.		OATS.	
	1909.	1910.	1909.	1910.	1909.	1910.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
London	42 9	32 4	26 9	20 2	20 11	19 3
Norwich	41 10	32 0	27 9	23 1	20 5	17 4
Peterborough	41 7	30 7	25 7	21 0	20 6	17 3
Lincoln	41 1	31 8	25 7	20 3	21 2	19 3
Doncaster	40 10	31 11	28 6	23 8	20 8	18 2
Salisbury	42 11	31 9	27 7	23 0	20 6	17 11

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND and SCOTLAND in the Month of May, 1910.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Bristol.		Liverpool.		London.		Glasgow.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British ..	15 0	14 0	—	—	12 9	11 6	14 3	—
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery	115 0	110 6	106 6	104 0	111 0	108 0	108 6	102 0
,, Factory	106 0	102 0	102 0	100 0	105 6	101 0	—	—
Danish ..	—	—	113 6	111 6	115 6	114 0	113 6	—
Russian ..	110 0	108 0	106 0	103 0	106 0	104 0	106 0	103 0
Australian ...	110 6	104 6	105 6	103 6	105 0	103 0	104 6	100 6
New Zealand	113 0	109 0	109 6	107 6	109 0	107 0	109 6	—
Argentine ...	110 6	106 6	104 0	102 6	107 0	104 6	110 0	—
CHEESE :—								
British—								
Cheddar ...	75 6	63 6	74 0	72 0	78 0	70 6	54 6	50 6
			120 lb.	120 lb.	120 lb.	120 lb.		
Cheshire ..	—	—	66 6	62 0	70 6	59 6	—	—
			per cwt.	per cwt.	per cwt.	per cwt.		
Canadian ...	61 6	59 6	60 0	58 0	64 0	61 0	60 0	57 0
BACON :—								
Irish	75 0	72 0	74 0	72 0	73 0	71 0	76 6	74 0
Canadian ...	72 0	70 0	71 0	69 0	71 0	—	72 6	70 6
HAMS :—								
Cumberland ...	—	—	—	—	112 6	102 0	—	—
Irish	—	—	—	—	107 0	99 0	101 6	92 6
American (long cut) ...	80 6	77 6	79 6	76 0	80 0	77 0	80 0	78 0
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British ...	8 11	8 1	—	—	9 2	8 4	—	—
Irish	7 8	7 5	7 5	7 1	7 11	7 5	7 3	6 11
Danish ...	—	—	7 8	—	8 11	7 7	8 5	7 4
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Langworthy ...	65 0	60 0	80 0	75 0	73 6	60 0	51 6	46 6
Scottish Triumph	68 6	60 0	48 6	45 0	70 0	58 6	—	—
Up-to-Date ...	71 6	55 0	48 6	45 0	70 0	58 6	46 0	42 0
HAY :—								
Clover ...	95 0	80 0	111 0	80 0	104 0	79 0	89 6	83 6
Meadow ...	80 0	65 0	—	—	93 0	69 6	—	—

DISEASES OF ANIMALS ACTS, 1894 to 1909.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

Disease.	May.		Five Months ended May.	
	1910.	1909.	1910.	1909.
Swine-Fever:—				
Outbreaks	159	178	569	738
Swine Slaughtered as diseased or exposed to infection ...	1,732	1,768	5,216	6,987
Anthrax:—				
Outbreaks	145	113	701	630
Animals attacked	174	133	854	838
Glanders (including Farcy):—				
Outbreaks	26	40	160	262
Animals attacked	94	144	422	1,027
Sheep-Scab:—				
Outbreaks	11	36	312	448

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)

Disease.	May.		Five Months ended May.	
	1910.	1909.	1910.	1909.
Swine-Fever:—				
Outbreaks	15	16	44	28
Swine Slaughtered as diseased or exposed to infection ...	241	237	1,053	354
Anthrax:—				
Outbreaks	—	1	4	3
Animals attacked	1	1	7	3
Glanders (including Farcy):—				
Outbreaks	—	—	1*	—
Animals attacked	—	—	2	—
Sheep-Scab:—				
Outbreaks	28	11	327	273

* This outbreak occurred in April.

SELECTED CONTENTS OF PERIODICALS.

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La Circulation de l'eau dans le sol et le sous-sol, *René d'Andrimont.* (Rev. Écon. internat., Vol. II., 1910.)

Denitrifikation und Stickstoffsammlung im Ackerboden, *F. S. Marr.* Der Stickstoffhaushalt des Ackerbodens (Zweite Mitteilung), *Th. Pfeiffer, A. Guttmann,* and *F. Thiel.* (Mitt. Landw. Inst. Breslau, Vol. V., No. 5, 1910.)

Field Crops—

Tobacco Growing in Ireland, *G. N. Keller.* (Dept. Agr. and Tech. Instr. Ireland, Jour., Vol. X., No. 3, 1910.)

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[NOTE.—The receipt of *annual* publications of foreign agricultural and other departments, experiment stations and societies is not noted in the monthly list of additions to the Library. A list of these publications appeared in the *Journal* for October, November and December, 1909.]

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COOMBE PLANTATION, KESWICK:
A Successful Plantation at a High Altitude.

R. L. Robinson, B.A., B.Sc., and A. Lindsay Watt, F.S.I.

One of the greatest difficulties which faces foresters in Great Britain is the lack of data on which to base calculations. The immediate cause of this deficiency is two-fold. In the first place, close accounts have not, save in exceptional cases, been kept of the cost of formation and of tending plantations which are now coming under the axe, and in the second place accurate records have not been made of the intermediate and final yields in produce and money. It is, therefore, impossible to tell, except in the vaguest terms, whether the operations have been a failure or success from a financial point of view.

It is not too much to say, then, that the most urgent need in connection with forestry in Britain is the collection and co-ordination of statistics in order that the State or the landlord may be able to estimate with some degree of certainty the costs which will have to be met during every period from the formation of the wood onwards, and the returns which may be expected from period to period under given conditions of soil, climate, aspect, elevation, and so on.

While it is perfectly true that *complete* detailed accounts have been kept of very few woods, yet there must be scattered over the length and breadth of these islands many woods of which partial accounts are available; and if all such data could be gathered together it should be possible to form

from the fragments tables which would go far to bridge the hiatus now existing. Such work would, at any rate, have to be done before any scheme of afforestation could be seriously undertaken.

It is hoped that the following account of Coombe Plantation may prove interesting in throwing some light on these points. The wood, which is the property of R. D. Marshall, Esq., of Castlerigg Manor, Keswick, is remarkable in several particulars. Mr. Marshall remembers seeing the planting when a boy, and now sixty years later is witnessing the clear-cutting of the wood. During that time he has kept close accounts of all costs and of all returns, and, further, in the year 1873, picked out experimental groups of trees of which he periodically measured the girths. To Mr. Marshall's foresight and public spirit we are indebted for the data on which the present paper is based.

The plantation is situated on the north side of the Whinlatter Pass about 3½ miles from Keswick, and lies for the most part between the 900 ft. and 1,500 ft. contour lines. The planting was begun in 1848, so that the present age is sixty-one years, and in 1903 the work of clear-cutting was begun.

In the present article an attempt will be made to discuss the effect of elevation and exposure on larch and spruce.*

General Description of the Plantation.—The wood is practically even-aged throughout, as the planting was completed in two years. The total area is 198 acres, distributed with regard to elevation as follows:—

Below 900 ft. contour line	3 acres
Between 900 ft. and 1000 ft. contour line ...	16½ ,,
,, 1,000—1,250 ft. ,, ,, ...	85 ,,
,, 1,250—1,500 ft. ,, ,, ...	69½ ,,
Above 1,500 ft. ,, ,, ...	24 ,,
	198 ,,

The stock below the 1,250 ft. contour line is practically pure larch, with spruce and Scotch pine interspersed singly and in small groups. In this part of the wood the last two species do not aggregate more than 1 to 2 per cent. of the whole. Above the 1,250 ft. line the proportion is greater, and averages about 10 per cent. A few silver firs were growing

* A financial account of the plantation will appear in the next issue of the *Journal*.

Plate No. 1—Exposed Edge of the Wood at an Elevation of about 1,500 feet.

originally at 1,250 ft., but have since been cut. A number of oak and birch were present in the original crop, but have mostly been removed in the thinnings. Those which remain are badly suppressed.

The Whinlatter Pass runs east and west, and the woods occupy the flanks of the somewhat steep slopes on the north side. About one-half of the wood faces south, while the other half lies on the slopes running down to Coombe Gill, and varies in aspect from S. to E.

The prevailing winds are from the W. and S.W., and sweep up the Pass with great fury in winter. On the N. side of Whinlatter the hills rise to a maximum of 1,700 ft. in the Lorton Fells, at a distance of one mile W. from Coombe Plantation, while to the S.W. Hobcarton, a mile distant, reaches 2,010 ft., and Grisedale Pike $1\frac{1}{2}$ miles distant, 2,600 ft. elevation. Further to the west the country falls off abruptly to the sea.

The position is partially exposed and partially sheltered. The slopes running down to Whinlatter Pass are exposed to the full force of the winds through the Pass, but that part which slopes down towards Coombe Gill is well sheltered in the lower parts. Above the 1,250 ft. contour line the wood becomes more and more exposed, and the upper parts, which reach up to the crest of the hill, are fully exposed to wind.

On the whole the locality is typical of thousands of acres of land in the Lake District at present let for a couple of shillings or less per acre.

In forming the plantation no windbreak was provided, and consequently the larch on the windward margins present a very weather-beaten appearance. Plate 1 is a view taken on the extreme western edge of the wood at an elevation of about 1,500 ft. The larch on the outside are mere bushes 5 to 8 ft. high, but increase in height within the wood under the shelter of the marginal trees. The characteristic streamer-like development of the branches of larch when exposed to heavy winds is well shown. Plates 2 and 3 have been included to illustrate the value of an evergreen shelter-belt in such situations. All three views were taken at practically the same elevation. No. 2 is a view taken about 50 yards from the edge of the wood, and shows the increased height attained

by spruce and by larch from such shelter. The height is about 25 ft., but both larch and spruce show considerable damage to the leading shoots.

In Plate 3 the larch have been sheltered by a group of spruce to the windward side. It will be observed that the trees are practically normal in development, and reach a height of from 30 to 35 ft.

The folly of planting larch in exposed situations without providing an efficient windbreak cannot be too strongly insisted on.

The wood has suffered considerably at various times from windfall, and especially is this the case along a low ridge which runs from S.E. to N.W. through the wood. On December 22nd, 1894, a heavy gale from the west overturned some 300 trees, while in the neighbourhood generally a great deal of damage was done to plantations. Locally, the storm was considered to be the most violent since that of the year 1839. In 1901 about 200 trees were blown over by a strong wind from the east.

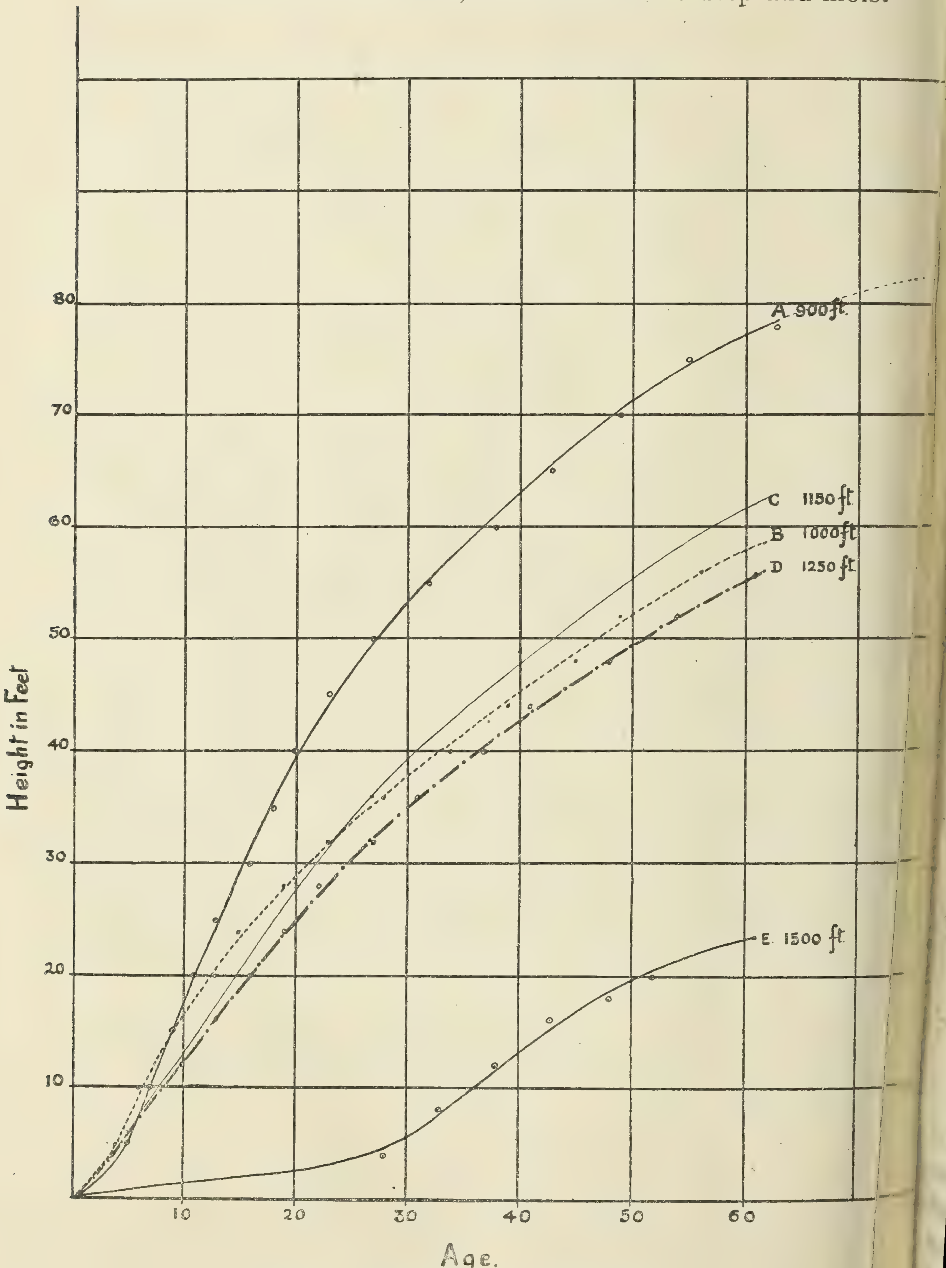
Fogs and mists are common along the Whinlatter Pass, and the rainfall somewhere about 50 ins. per annum (the rainfall at Keswick, 700 ft. lower, is 44 ins.). Snow is not uncommon in winter, but does not lie about for long at a time, and has done little damage.

The locality suffers somewhat from both early and late frosts. Frosts are fairly common as late as the end of May.

The soil is a loam with a rubbly subsoil formed by the disintegration of the underlying shales, which are of Ordovician Age (Skiddaw Series). The depth of the soil varies from 12 ins. to 15 ins. in the little valleys to a couple of inches or less on the ridges, while the subsoil may be a couple of feet deep, or practically wanting. On the other hand, there is everywhere sufficient soil to carry trees, and no deductions in area have to be made for crags or rocky places. The number of trees per acre varies considerably. In the more elevated portions of the wood, where the trees are smaller, they naturally stand closer together, while in the lower parts the thinnings have in many parts been so heavy that they have practically amounted to partial clearings.

[Pl]ATE No. 2—Larch and Spruce at an Elevation of about 1,500 feet, Sheltered only by a 50-yard Strip of Larch to Windward.

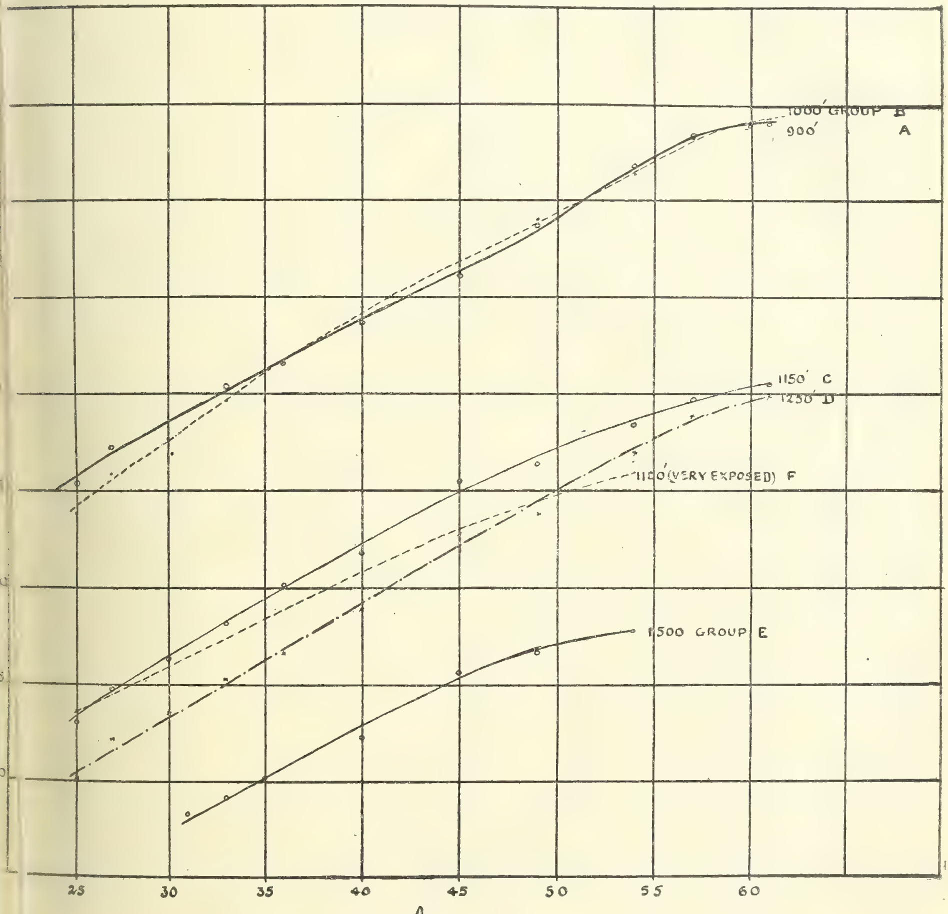
ground) are attained in 62 years. Larch grows best in the somewhat sheltered hollows, where the soil is deep and moist



CURVE A.—HEIGHT-GROWTH CURVE FOR LARCH.

but well drained, and falls off to a considerable degree o stony ridges where the soil is shallow and drier. This fallin

off is well illustrated by some measurements made in the vicinity of an experimental group at an elevation of 1,150 ft. The average height of the trees of the group, which is situated in a hollow, is 62 ft., with a volume of 18 cubic ft. quarter-girth measurement; while on the adjacent ridges 10 yards



CURVE B.—GIRTH CURVE FOR LARCH.

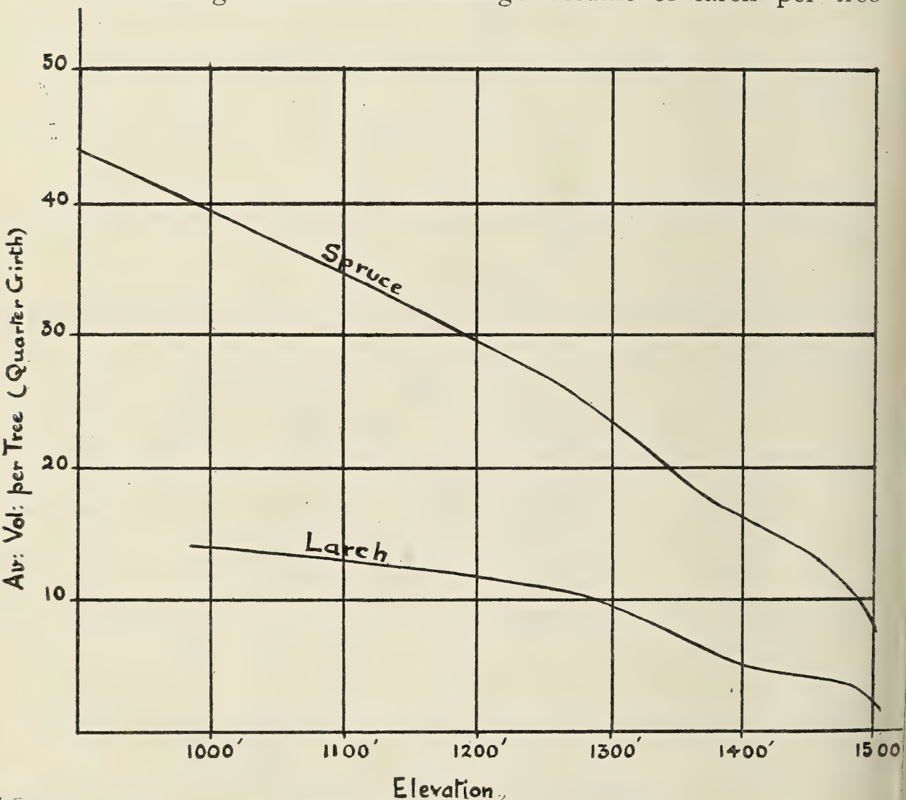
distant the height falls off to 47 ft., and the volume to 8 cubic ft. quarter-girth.*

While thriving best in breezy situations, the larch cannot stand exposure to heavy winds. This point has already been illustrated by Plates 1, 2, and 3. It will be seen from the

* Mr. Marshall's girth measurements were made at a height of 4 ft. from the ground. The form factors, however, have been calculated, for the sake of comparison with other form factors, with reference to the diameter at breast-height (4 ft. 3 in.). The quarter-girth volume has been taken throughout at ·75 of the true volume.

elevation-volume curve below that the average volume attained by larch at 1,350 ft. is about 7 cubic ft. quarter-girth. Measurements of a group of larch occupying a particularly well-sheltered situation at the same elevation showed that the average volume attained was 13·5 cubic ft. quarter-girth.

A further reference to the same curve will show that with increasing elevation the average volume of larch per tree



CURVE C.—ELEVATION-VOLUME CURVE.

shows a steady decrease until an elevation of 1,250 ft. is reached, when the decrease becomes more rapid. This is due to the conformation of the ground, resulting in an aspect which rapidly becomes more and more exposed. At 1,500 ft. the trees do not average more than 2·5 cubic ft. per tree, and it is evident that the plantation has not been a success financially at this elevation. This point will be referred to again.

An interesting phenomenon has taken place on the steep

Plate No. 3—Spruce and Larch at an Elevation of about 1,500 feet, Sheltered by a Group of Spruce on the Windward Side.

hillside to the east (leeward side) of Coombe Plantation, and to a less degree to the west also. The seed from the Coombe larch have been carried by the wind, and although the hillsides are thickly covered with heather and have been continually grazed by sheep, natural regeneration has taken place over a considerable area. Plate 4 is a general view of the regeneration area to the east of Coombe Plantation, and shows the crop of young larch. The seed has in some cases been carried over 300 yards. Plate 5 is a close view of the same area, and shows the heavy covering of heather on the ground. The young crop is naturally somewhat uneven, and some of the stems are cankered from wounds made by sheep, but the trees are, on the whole, growing very well, and at a comparatively small cost a successful wood could be formed. The example shows that with the exclusion of sheep and a little working of the ground, natural regeneration of larch under such conditions should not be a very difficult matter.

Spruce grows well at all elevations, and everywhere attains a greater volume than larch under the same conditions. The growth is particularly good along the shallow water-courses, where specimens of up to 80 cubic ft. (quarter-girth) have been cut. Generally, however, this great volume has been obtained by growing the trees in too open stand, with the result that the boles are of large diameter but knotty and fluted, and taper rapidly.

In the bottom parts of the wood isolated spruce have attained a height of 80 ft. and a volume of 44 cubic ft., but the volume falls off in much the same way as does that of the larch with increasing elevation. At 1,150 ft. the average volume is 32 cubic ft.; at 1,250 ft., 26 cubic ft.; and at 1,500 ft., 8 cubic ft. quarter-girth. Here and there a few seedling spruce have sprung up naturally under the larch, but nowhere in considerable numbers.

Scotch pine occurs chiefly as isolated specimens or in small groups among the larch, and is mainly confined to a comparatively small area between the 1,250 ft. and 1,500 ft. contour lines. The average cubic contents of some 66 trees felled here in 1907 was 9·6 cubic ft. quarter-girth, and the average height about 33 ft. This tree has suffered from the heavy thinnings which have been made in the larch, and is con-

sequently often very knotty and coarse, and has little or no heartwood.

Scotch pine might, with advantage, have been grown on some of the low ridges at present occupied by larch. As shown by the rounding off of its crown, Scotch pine has at its present age (62 years) completed its principal height-growth under these conditions.

Silver fir is much less abundant than either spruce or Scotch pine, and is growing only in a sheltered locality at 1,250 ft. elevation. The growth there has been remarkably good, and 21 trees felled in 1907 had an average volume of 27 cubic ft. quarter-girth. It seems probable that this species, with its shade-bearing properties, would be extremely useful for planting in mixture with the light-demanding larch. Its slow growth in early youth should give the larch a good start, and at the same time it should survive the shade of the latter until such time as heavier thinnings were made, when it should begin to forge ahead.

With regard to the relative rates of growth of larch, spruce, and Scotch pine, it may be said that spruce is now for the first time taking the lead, and overtops the larch by a foot or so, while the Scotch pine is overtopped by the larch by a similar amount. Under such conditions of growth, a mixture of spruce and larch should thrive well, as far as the larch is concerned, although in such a mixture the timber of the former is hardly likely to be of the best quality.

THE EXPERIMENTAL GROUPS.

Experimental groups of trees, for the most part larch, were picked out in the year 1873, and the girths of the individual trees recorded from year to year.

Unfortunately, no records of the height-growth from period to period have been kept, and to fill this deficiency a sample tree, equalling as nearly as convenient the average height of the group, was felled in the vicinity of each group. Each tree was then cut up into sections varying in length from 4 to 6 ft., the rings at each section carefully counted, and the diameters measured. In this way it was possible to reconstruct the height-growth, and to arrive at approximate form factors for the volume of larch. The form factors so

Plate No. 4—General View of the Natural Regeneration of Larch on the Hillside E. of Coombe Plantation; Elevation 1,100 feet to 1,450 feet

obtained were then used in finding the volume of the trees of the group and of the whole area. The breadth of the rings was also measured on each section of three of the trees in order to find the volume (without bark) at different periods, and thus to calculate the periodic increment. The data obtained in this way have been tabulated in Tables I. and II. (at end).

Some nine or ten groups of five trees each were in this way established at various elevations, and of these the following have been chosen for description as the most interesting:—

Group A.—At 900 ft. elevation; number of trees, 4. The aspect is east, the soil deep, moist and well-drained, and the group is generally well sheltered. Two of these trees were on the margin of the wood, and had received more than a fair share of light. A reference to the height-growth and girth curves will show that these are the most favourable conditions for the growth of larch. The sample tree felled reached a total height of 78 ft., and a girth of 45 ins. at breast-height. The form factor was ·440. The average volume of the group was 54·0 cubic ft. (true volume), or 40·5 cubic ft. quarter-girth.

The trees at this elevation are still continuing to grow vigorously, as is shown by the leading shoots of 8 ins. for both 1908 and 1907, and the height may be expected to increase to about 81 ft. at the age of 70.

Analysis of the sample stem showed that the increment for the last five years was 2·3 per cent. per annum, and for the preceding periods of five years 2·4 per cent., 3·81 per cent., 4·1 per cent., and 4·65 per cent. respectively. The volume increment, therefore, first began to fall below 3 per cent. at about the age of 55 years. The low rate of growth during the last five years has probably been affected by the successive defoliations by the Large Larch Saw-fly.

Group B.—At 1,000 ft. elevation; number of trees, 5. The aspect is south, the soil about 9 ins. deep and fairly moist, the slope gentle, and the locality moderately sheltered by other larch. The sample tree felled was not a particularly good example of the group, which borders on the edge of the wood and on a road, and has therefore received an inordinate

amount of light. This is brought out in the girth curve, the average girth being 54 ins.

The sample tree (B) was taken from a somewhat crowded position, and had apparently been suppressed between the ages of 15 and 30 years, with the result that it has been surpassed in height-growth by the sample tree (C) at 1,150 ft. The average height reached by the group was 65 ft., and the average volume 44 cubic ft. true volume, or 33 cubic ft. quarter-girth. On the other hand, the average volume of 23 trees measured in the vicinity of the group was only 14·2 cubic ft. quarter-girth.

The increment of the sample tree was 2·35 per cent. during the last five years, and 2·5, 3·5, and 3·8 per cent. respectively for the preceding periods of five years.

Group C.—1,150 ft. elevation; number of trees, 4. The group lies on the banks of a shallow valley, with southern aspect in general. The soil is moist and deep, and the locality well sheltered. Under these conditions the sample tree, which was a good representative of the group, reached a total height of 62 ft., with a girth of 38 ins. at breast-height, a form factor of ·423, and a volume of 20·93 cubic ft. true volume.

The average volume of the group was 24 cubic ft. true volume, or 18 cubic ft. quarter-girth. The average volume of 19 trees measured in the vicinity of the group was 12·0 cubic ft. quarter-girth. The increment was 3 per cent. at the age of 52, 2·5 per cent. at 57, and for the last five years has averaged about 2·2 per cent.

Group D.—Elevation, 1,250 ft.; number of trees, 4. The aspect is south-east, the slope gentle and moderately sheltered by other larch; with average soil conditions. The sample tree was a good representative of its group, and had a total height of 55 ft. 8 ins., a girth at breast-height of 36 ins., a form factor of ·436, and a volume to 4 ins. least diameter of 17·4 cubic ft. true measurement. The average volume of the group was 14·5 cubic ft. per tree, and the average volume of 17 trees in the vicinity 11·0 cubic ft. quarter-girth.

Group E.—Elevation, 1,500 ft.; number of trees, 3. This group was felled in 1902. The aspect was south-east to east and exposed, and the soil not more than 6 ins. deep. The

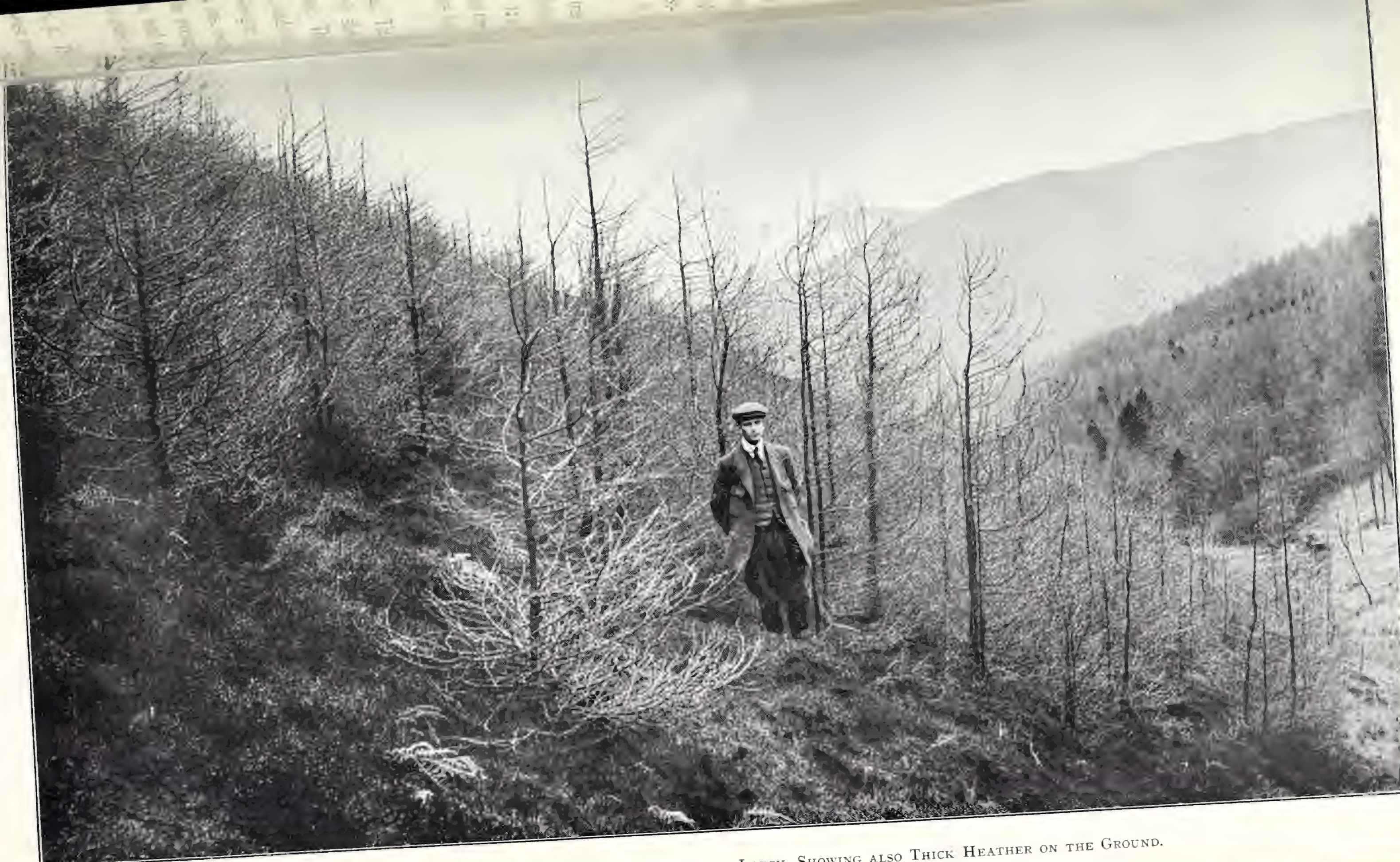


Plate No. 5—Close View of Natural Regeneration of Larch, Showing also Thick Heather on the Ground.

sample tree was a fair representative of larch grown at such altitude with no shelter save a narrow belt of other larch. The total height reached was 23 ft. 8 in., and the girth breast-height $21\frac{1}{4}$ ins.; these dimensions, with a form factor of ·49, give a volume to 4 ins. diameter of 2·9 cubic ft. true measurement, and such is about the average volume of larch at this elevation.

A glance at the height-growth curve will show how extremely slow the growth of this tree was up to the age of about 30 years. The tree found great difficulty in getting a start owing to exposure to wind, and when, finally, some shelter was obtained from the other larch to windward, and the tree began to forge ahead, the effort came too late in life to carry the tree to a respectable height.

Group F.—Elevation, 1,100 ft. This group was in a very exposed position, and finally, in the storm of 1894, all the trees were blown down. The figures to that date, however, show clearly the effect of exposure to wind on the girth-growth. It will be observed that the curve for the group (see curves, p. 271) cuts across the curves for both the 1,1150 ft. and 1,250 ft. groups. While the effect of exposure to wind on height-growth is sufficiently obvious, one is apt to overlook the resulting decrease in diameter. No sample tree was taken to represent this group.

EFFECT OF ELEVATION ON THE GROWTH OF LARCH AND SPRUCE.

It will be seen from the curves that there is, except in the height-growth curve for the tree at 1,000 ft. elevation, a general falling off in both height and girth with increased elevation. From the data obtained from the experimental groups of larch and from measurements of trees in the vicinity of each group, it has been found possible to construct curves which show the relation of the average volume per tree to the elevation (see curves, p. 272).

Between the elevations of 1,250 ft. and 1,500 ft., where no experimental groups were measured, the curves have been constructed for larch and for spruce from the volumes of some 2,900 larch and 285 spruce felled in 1907–8, supplemented by measurements of trees felled during the present year.

It will be noticed that from 1,000 ft. to 1,250 ft. the larch

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It will be noticed that from 1,000 ft. to 1,250 ft. the larch

suffers a gradual decrease in volume from 14 to 11 cubic ft., or approximately $8\frac{1}{2}$ per cent. per 100 ft. of ascent. From 1,250 ft. the decrease is more abrupt, probably owing to a change in the topography of the land which resulted in increased exposure to wind. The average volume falls off to 5 cubic ft. at 1,400 ft., 4·5 at 1,450 ft., and 2·5 cubic ft. at 1,500 ft. All the measurements are quarter-girth.

In the case of spruce, since there are no experimental groups, measurements were made at various elevations of the small groups scattered over the area. It must be pointed out that the curve is not a true gauge of what the land would carry under spruce, since the trees have nowhere been grown close together as in a full crop. While the spruce has, under these conditions, put on a greater volume than would be normally obtained *per tree,* its isolation among a lot of larch has often resulted in its suffering damage from wind to a degree which would not occur if it were grown in dense masses.

The average volume falls gradually from 44 cubic ft. at 900 ft. to 27 cubic ft. at 1,250 ft., and somewhat abruptly to 15 cubic ft. at 1,430 ft., and then very abruptly to 7 cubic ft. quarter-girth at 1,500 ft., the curve following a course very similar to that for larch.

The resemblance between the two and the general shape of the two curves are perhaps of more than passing interest. That part of each curve which lies between 1,000 ft. and 1,250 ft. is practically a straight line; and since the conditions as regards exposure are practically constant, one might conclude that the gradually decreasing volume is due solely to increased elevation and decreasing vegetative activity. If such be the case, one finds that under similar conditions the larch would attain a volume of about 8 cubic ft. at 1,500 ft., and 7 cubic ft. at 1,600 ft., while the spruce should attain 14 and 10 cubic ft. respectively at these elevations. Well-sheltered localities at such elevations are, of course, rare, but they do exist in the Lake District, notably in the Coombes on the north and east sides of the higher mountains. If such volumes can be actually attained, plantations at these elevations and under these conditions should pay well, but in the absence of data this must be regarded as a mere expression of opinion and a suggestion for experimental work.

In 1884 certain trees of each group were manured with superphosphate of lime, which was raked in round the roots. It is possible that this treatment may have had a beneficial effect on the height-growth, but the trees have not yet been felled. No acceleration in girth increment appears to have been brought about.

(To be continued.)

TABLE I.—ANALYSIS OF STEMS.

Height of section above ground.	900 ft. Tree A.		1,000 ft. Tree B.		1,150 ft. Tree C.		1,250 ft. Tree D.		1,500 ft. Tree E.	
	No. of rings.	Age corre-sponding to height.	No. of rings.	Age corre-sponding to height.	No. of rings.	Age corre-sponding to height.	No. of rings.	Age corre-sponding to height.	No. of rings.	Age corre-sponding to height.
Base	63	—	62	—	61	—	61	—	61	—
4 ft.	—	—	—	—	—	—	—	—	33	28
5	58	5	58	4	—	—	—	—	—	—
6	—	—	—	—	55	5	55	5	—	—
8	—	—	—	—	—	—	—	—	28	33
10	56	7	56	6	—	—	—	—	—	—
12	—	—	—	—	51	10	51	10	23	38
15	54	9	53	9	—	—	—	—	—	—
16	—	—	—	—	49	12	48	13	18	43
18	—	—	—	—	—	—	—	—	13	48
20	52	11	49	13	46	15	45	16	9	52
24	—	—	47	15	43	18	42	19		
25	50	13	—	—	—	—	—	—		
28	—	—	43	19	41	20	39	22		
30	47	16	—	—	—	—	—	—		
32	—	—	39	23	38	23	34	27		
35	45	18	—	—	—	—	—	—		
36	—	—	34	28	34	27	30	31		
40	43	20	28	34	31	31	24	37		
44	—	—	23	39	24	37	20	41		
45	40	23	—	—	—	—	—	—		
48	—	—	17	45	19	41	13	48		
50	36	27	—	—	—	—	—	—		
52	—	—	13	49	15	45	7	54		
55	31	32	—	—	—	—				
56	—	—	6	56	10	51				
60	25	38								
64	—	—								
65	20	43								
68	—	—								
70	14	49								
75	8	55								
78	—	63								
	Total height. 78 ft. 0 in.		Total height. 58 ft. 9 in.		Total height. 62 ft. 0 in.		Total height. 55 ft. 8 in.		Total height. 23 ft. 7 in.	
	Leading shoots.		Leading shoots.		Leading shoots.		Leading shoots.		Leading shoots.	
	1909	5 in.	1909	4 in.	1909	11 in.	—		—	
	1908	8 in.	1908	8 in.	1908	5 in.	—		—	
	1907	8 in.	1907	8 in.	1907	6½ in.	—		—	

TABLE II.—VOLUMES OF

Height of section above ground.	900 FEET TREE A.					1,000 FEET TREE B.				
	Diameters over bark in inches.			Area section sq. ft.	Volume of piece cub. ft.	Diameters over bark in inches.			Area section sq. ft.	Volume of piece cub. ft.
	a.	b.	Mean.			a.	b.	Mean.		
Base	19·0	16·0	17·5	1·670		12·5	11·5	12·0	0·785	
4 ft.	—	—	—	—	6·550	—	—	—	—	3·300
5	12·9	13·5	13·2	0·950		10·1	9·7	9·9	0·535	
6	—	—	—	—		—	—	—	—	
8	—	—	—	—	4·4725	—	—	—	—	2·4675
10	12·2	12·6	12·4	0·839		9·4	8·8	9·1	0·452	
12	—	—	—	—	4·160	—	—	—	—	2·210
15	11·8	12·4	12·1	0·825		9·3	8·5	8·9	0·432	
16	—	—	—	—		—	—	—	—	
18	—	—	—	—	3·8975	—	—	—	—	1·9525
20	11·7	11·5	11·6	0·734		8·2	7·8	8·0	0·349	
24	—	—	—	—	3·6375	7·9	7·9	7·9	0·340	1·378
25	11·7	11·3	11·5	0·721		—	—	—	—	1·294
28	—	—	—	—	3·305	7·6	7·4	7·5	0·307	
30	10·6	10·4	10·5	0·601		—	—	—	—	1·090
32	—	—	—	—	2·8925	6·9	6·3	6·6	0·238	
35	10·3	9·9	10·1	0·556		—	—	—	—	0·882
36	—	—	—	—	2·545	6·2	6·0	6·1	0·203	
40	9·4	9·0	9·2	0·462		5·1	4·9	5·0	0·136	0·678
44	—	—	—	—	2·1875	4·8	4·6	4·7	0·121	0·514
45	8·7	8·7	8·7	0·413		—	—	—	—	0·436
48	—	—	—	—		4·2	4·2	4·2	0·097	
					1·840					16·202
50	7·7	7·7	7·7	0·323						
52	—	—	—	—	1·365					
55	6·5	6·3	6·4	0·223						
56	—	—	—	—	0·955					
60	5·4	5·4	5·4	0·159						
					0·6275					
65	4·1	4·1	4·1	0·092						
70										
75	Total volume				38·435					

Tree A:

Total vol. to 4 in. diameter 38·435

Total length .. ... 78 ft. 0 in.

Circumference breast ht. 45 in.

Form factor $(f) = 0{\cdot}440$.

Tree B:

Total vol.: to 4 in. diameter 16·202

Total length ... ... 58 ft. 9 in.

Circumference breast ht. 33 in.

Form factor $(f) = 0{\cdot}458$.

S[illegible]MPLE TREES.

1,150 TREE C. FEET.

[illegible]meters over [illegible]k in inches. a.	b.	Mean.	Area section sq. ft.	Volume of piece cub. ft.
16[illegible]	12·1	14·3	1·115	
—	—	—	—	5·289
—	—	—	—	
11[illegible]	10·5	10·9	0·648	
—	—	—	—	
—	—	—	—	3·612
10[illegible]	10·0	10·1	0·556	
—	—	—	—	2·138
[illegible]	9·7	9·7	0·513	
—	—	—	—	1·950
9[illegible]	8·9	9·2	0·462	
8[illegible]	9·0	8·6	0·403	1·730
—	—	—	—	1·594
[illegible]	8·4	8·5	0·394	
—	—	—	—	1·468
8[illegible]	7·7	7·9	0·340	
—	—	—	—	1·184
7[illegible]	6·3	6·8	0·252	
6[illegible]	6·2	6·1	0·203	0·910
4[illegible]	4·9	4·7	0·120	0·646
—	—	—	—	0·414
4[illegible]	4·0	4·0	0·087	
				20·935
2·[illegible]	2·3	2·3	—	

T[illegible] vol. :
[illegible] 4 in. diameter 20·935

T[illegible] length ... 62 ft. 0 in.

Cir[illegible]mference
breast ht. 38 in.

For[illegible] factor $(f)=0·423$

1,250 TREE D. FEET.

Diameters over bark in inches. a.	b.	Mean.	Area section sq. ft.	Volume of piece cub. ft.
13·3	12·7	13·0	0·922	
—	—	—	—	4·503
—	—	—	—	
10·8	9·8	10·3	0·579	
—	—	—	—	
—	—	—	—	3·246
10·1	9·1	9·6	0·503	
—	—	—	—	1·930
9·4	9·0	9·2	0·462	
—	—	—	—	1·808
9·0	9·0	9·0	0·442	
8·2	7·8	8·0	0·349	1·582
—	—	—	—	1·296
7·5	7·3	7·4	0·299	
—	—	—	—	1·132
7·4	6·6	7·0	0·267	
—	—	—	—	0·952
6·6	5·8	6·2	0·209	
5·0	4·8	4·9	0·131	0·680
3·5	3·5	3·5	—	0·272
				17·401

Total vol. :
to 4 in. diameter 17·401

Total length ... 55 ft. 8 in.

Circumference
breast ht. 36 in.

Form factor $(f)=0·436$.

1,500 TREE E. FEET.

Diameters over bark in inches. a.	b.	Mean.	Area section sq. ft.	Volume of piece cub. ft.
8·0	7·8	7·9	0·340	1·4075
6·6	6·2	6·4	0·223	
—	—	—	—	
—	—	—	—	·8975
5·1	4·9	5·0	0·136	
—	—	—	—	0·5575
4·0	4·0	4·0	0·087	
				2·8625

Total vol. : to 4 in. diameter, 2·8625 cub. ft.

Total length : 23 ft. 7 in.

Circumference
breast ht. 21·25 in.

Form factor $(f)=0·486$.

TABLE III.—

	No.	1873. Girths.	1873. Mean.	1875. Girths	1875. Mean.	1878. Girths.	1878. Mean	1879. Girths.	1879. Mean.	1881. Girths.	1881. Mean.	1883. Girths.	1883. Mean.	1884. Girths.	1884. Mean.
Group A 900 ft.	1	38		41		42¾		—		46½		—		48¼	
	3	33½		35		36½		—		38½		—		40	
			35·3		37·2		38·3		—		40·4		—		41·5
	4	33½		35		35½		—		36		—		36½	
	5	36		37½		38¼		—		40		—		40½	
Group B 1,000 ft.	11	33		34¾		36½		—		39		—		41¾	
	12	42		45		47		—		49		—		51¾	
			33·8		35·9		37·7		—		39·7		—		42·3
	13	28		30		32		—		33½		—		35½	
	14	33½		34¾		35¾		—		37¼		—		39¾	
	15A	31		33		35¾		—		38		—		41¼	
Group C 1,150 ft.	41	24½		26½		28		—		30		—		32½	
	43	23		25		26		—		27		—		28	
			23·0		24·8		26·4		—		28·2		—		30·1
	44	20		21½		23		—		25		—		26½	
	45	24		26		28¼		—		30½		—		33	
Group D 1,250 ft.	46	18½		23		25		—		27		—		29¼	
	47	24		25		26½		—		28½		—		29¾	
			20·2		22·2		23·5		—		25·3		—		26·
	48	19		20½		21½		—		23		—		24½	
	49	19		20		20½		—		22		—		22½	
Group E 1,500 ft.	1	—		—		—		18		18¼		19		—	
	2	—	—	—	—	—	—	19½	18·3	20¾	19·2	21¾	20·1	—	—
	3	—		—		—		17¼		18½		19½		—	

GIRTHS IN AUTUMN.

1888.		1893.		1897.		1898.		1902.		1905.		1908.		1909.	
Girths.	Mean.	Girths.	Mean.	Girths.	Mean.	Girths.	Mean.	Girths.	Mean.	Girths.	Mean.	Girths.	Mean.	Girths.	Mean.
51¼		54		58½		—		63		64¾		65¼		65½	
42		45		46¾		—		49½		52		52½		52½	
	43·6		46·0		48·7		—		51·8		53·4		53·8		53·8
38		40		42		—		44¾		46		46		46	
42		44		46		—		48		49		49½		49½	
4¼		46		49½		—		52½		54¾		55¾		57	
4¼		55½		58		—		60¼		62½		62¾		62¾	
	44·5		46·1		49·0		—		51·3		53·4		54·0		54·4
7		38		39¾		—		41		42¼		42¾		42½	
1½		43		45¾		—		47¾		49¾		50		50¼	
3¾		46		50		—		53		55½		56½		57¼	
4½		38¾		39½		—		41½		42½		—		43¾	
9¼		32		32¾		—		34½		36		—		37	
	31·9		35·5		36·3		—		38·4		39·7		—		40·5
9		32¼		33½		—		36½		38½		—		39	
4½		38¼		38¾		—		40½		41½		—		42	
2½		37¾		40		—		45		48		—		49¼	
1¾		35		36		—		38½		40		—		41¼	
	28·9		32·8		33·9		—		37·0		38·8		—		39·9
5½		30½		31¾		—		34½		35¾		—		37¼	
[illegible]		26¾		26½		—		27¾		29		—		29¼	
		24¼		—		—		26½		—					
¼	22·3	28	25·6	—	26·7	—	—	31	27·8	—	Cut	in	1902		
½		24¼		—		—		25¾		—					

MENDELISM, AND ITS APPLICATION TO STOCKBREEDING.

A. B. BRUCE, M.A.

Department of Agriculture, Cambridge.

Signs are not wanting that the researches in the science of heredity associated with the name of Mendel are awakening the interest of practical men. The appointment of the leading expert in Mendelian research to the Directorship of the Innes Institute at Merton suggests that horticulturists, at any rate, anticipate that practical results are likely to follow the application of the new methods to garden plants. That agriculturists, too, are not behindhand in recognising the value of the new science, as applied to the plants of the farm, is shown by the recent appointment of Professor Biffen as Botanist to the Royal Agricultural Society of England. Professor Biffen's success in producing new and valuable varieties of wheat is now a matter of common knowledge.

The value of Mendelian methods, when applied to the production of new varieties of plants, is both theoretically and practically beyond dispute, but the application of these methods to the breeding of animals stands on another and different footing; results of economic importance have not been achieved so far, and it is still doubtful, theoretically, whether the new methods are applicable to the problems in which practical men are interested. Stockbreeders, as a rule, have not, up to the present, devoted much attention to the matter, and it would seem that the mathematical aspect, which finds a place even in professedly popular accounts of the theory, is an obstacle which, to some minds, proves insurmountable. If, however, the *facts*, established by the Mendelian school, be dissociated from the theories which have been framed to explain them, there is nothing in the new science that the ordinary reader need have any difficulty in comprehending.

In the first place, to clear the path, it is necessary to point out that Mendelian methods and discoveries are concerned with, and confined to, the inheritance of distinct and mutually exclusive characters only. For example, a flower is either coloured or white; colour and whiteness are an example of

such characters. Thus the Mendelian can predict what will happen when, say, a white breed of rabbit is mated with a coloured one; he cannot predict the result of mating a large animal with a small one; he can foretell the colour of the eyes of the children of two blue-eyed parents; he is ignorant of the law determining their height. Confining our attention, then, to the inheritance of sharply defined characters, of which colour will serve as a type, the root principle of Mendelism may be simply stated. It is that many, if not all, such characters behave as distinct units in inheritance, and *may* be present (or absent) in the offspring, *dissociated from the other characters present in either of the parents*, in accordance with certain definite numerical laws. For example, a child may have the blue eyes of its father, but all its other colour characters from its brown-eyed mother; moreover, the Mendelian law enables us to affirm that the blue-eyed child has no dark-eyed character in its "blood," even though its mother had dark eyes; in other words, the offspring of this blue-eyed child, if mated with another blue-eyed individual, will never show any "reversion" to dark eyes. It cannot, however, be asserted that the offspring of two dark-eyed parents will all have dark eyes, for it is a fact that, whereas the blue eye is always "pure," in the sense that it breeds true, the dark eye, on the other hand, is sometimes pure and sometimes impure, the "impurity" consisting in the fact that the blue-eyed character is sometimes latent and likely to appear in the offspring. In Mendelian terminology, dark eye is "dominant" to the "recessive" light eye. It must be clearly understood that dominance is not an essential of the Mendelian law; the root idea is that certain characters are independent units, the transmission of these units from parent to offspring being entirely independent of the inheritance of other units which may distinguish the parent individual.

It is clear that we have here an entirely novel conception of heredity. The ideas hitherto prevalent, if capable of definition at all, are associated with the use of the word "blood" in connection with heredity. It is assumed that, as the child is of the same blood as its parent, it carries, in its constitution—it may be latently—something of all the

characters of the parents, and this something may appear at any time, by hazard, in the descendants of that child. The Mendelian conception, on the other hand, is that the factor on which any one of the characters of an individual depends may be replaced by some other factor in the child, and that the first factor, once having disappeared from the "blood," will not reappear until introduced from the outside by mating with another individual which carries the missing factor—whether patent or latent—in its "blood."

This idea may be stated in another way. The Mendelian regards the individual as a mosaic, the pieces of which are partly apparent and partly concealed; the child is a mosaic of pieces derived partly from one parent and partly from the other: if a piece, A, of one parent is replaced by another, B, in the child, A will not appear in the descendants of that child unless it is reintroduced from outside by marriage. The popular idea, on the other hand, is that the characters of the parent are inextricably blended, or fused together, or, as it were, dissolved in the blood, and that, consequently, the child carries some portion of *all* the characters of the parent, and thus transmits them to future generations, their appearance on the surface being possible at any time through the working of the mysterious principle of reversion.

To give an example of the application of these principles to concrete instances, we cannot do better than describe an experiment carried out by Professor Wood at Cambridge, which formed the subject of an interesting lecture recently delivered by him to the Farmers' Club in London. The distinguishing points of the Dorset and Suffolk breeds of sheep are well known; briefly, the Suffolk is black-faced and hornless, while the Dorset is white-faced and horned. Now, if the two characters, face colour and horns, follow Mendelian laws, it should be possible to produce a sheep having the white face of the Dorset combined with the absence of horns characteristic of the Suffolk, and, moreover, one which will breed true to this novel combination. Further, the desired result should be attainable by breeding two generations only. And so it proved; for, by breeding together the first crosses between Dorsets and Suffolks, there was obtained a ram having all the points of the Suffolk except that, instead of

having a black, it had a white face. It is clear, therefore, that the something, whatever it may be, that causes the blackness of the Suffolk is inherited independently of the other characters, and can be replaced by the something which produces whiteness, just as we can pick out one piece of a mosaic and replace it by one of another colour without disturbing the remainder of the picture. The method adopted to secure this rearrangement of the mosaic is simply to interbreed the first crosses between individuals containing the pieces we want, knowing that the offspring of the union, if sufficiently numerous, will include the new combination we are in search of.

A question which will at once suggest itself to a practical man is: Is the new individual pure? Will its progeny not occasionally revert to some of the ancestral characters which it does not show? Now, in the case of the white, hornless ram, described above, we know that it will breed true because, from observing the first crosses, we know that if the factor that causes horns is present in a ram, the animal will have horns, and if the blacking factor is present, the face is speckled. In Mendelian phraseology, a recessive character is always pure. But if a similar experiment had been carried out with cattle, the position of affairs would have been reversed; for, in the case of cattle, we have good reason to believe that the hornless condition is dominant to the horned condition, or, in ordinary language, the offspring of horned cattle, whatever their immediate ancestry may have been, will all be horned, whereas a polled animal *may* carry the horned condition in its blood, and so produce horned offspring. It must be clearly understood that this quality of dominance is accidental and not essential to the Mendelian hypothesis, and that until actual experiment has been made it is impossible to say whether it will manifest itself. Thus, to return to the previous example, there is no dominance in regard to face colour; if the white and black determinants are both present, the face is speckled. In regard to wool colour, however, we have reason to believe that white is dominant to black, and that the appearance of black-woolled sheep in a pure race of white sheep is due to the accidental mating of two individuals each carrying a recessive black

determinant. Similarly, black is apparently dominant to red in the Angus and Galloway breeds of cattle, while in other breeds, if both black and red are present, we get the brindled marking.

In stating the method in which new combinations are produced, it has been said that the offspring of the first crosses, if sufficiently numerous, will include the desired result. The proviso must not be lost sight of, for it points to the most formidable obstacle in the way of researches into the laws of heredity in domestic animals. If we set out to modify two characters of an animal, it can be shown that there is only one chance in sixteen that the second generation will contain what we want; if we wish a new combination of three characters, the chances are one in sixty-four; each additional factor multiplies the chances against by four. Next, we have the complexity resulting from the separation of the sexes in animals. It will be readily understood why plants provide the best material for such researches; by self-fertilising a plant, we can ensure that both the male and the female elements are of the same constitution, both visually and latently, and the breeding of the large numbers required presents no great difficulty. But all these obstacles to the application of the new methods to the larger animals appear insignificant when it is pointed out that the territory so far explored by the followers of Mendel is really, from an economic point of view, a very limited one. For the laws of inheritance of such indefinite characters as size, shape, fertility, vigour, are still unknown. If, for example, we select such an important problem as the combining in one breed of a high standard of beef and milk production, the indefiniteness which characterises these points, as contrasted with, say, horns and no horns, renders the application of Mendelian methods to the problem almost inconceivable, not to speak of the impossibility of testing males for milk-producing capacity.

The Mendelian does not depreciate the value of the time-honoured method of selection in attacking such problems; he only hopes to discover the laws which govern the variations which the breeder has hitherto left very largely to chance; moreover, he suspects that the improvement in any

desired direction which can be attained by selection within pure breeds lies within very narrow limits, which in most cases have already been reached. There is another important economic principle in stockbreeding which, so far, has no Mendelian explanation. It is well known that continued in-breeding leads to loss of vigour, a fact which, perhaps, accounts for the superiority of the cross-bred for fattening purposes. Darwin's dictum that "Nature abhors perpetual self-fertilisation" is of no higher scientific value than the mediæval "Nature abhors a vacuum" is an explanation of the rise of water in a pump. That all the offspring of incestuous unions are not degenerate is proved by Cossar Ewart's experiments on goats; cereals maintain their fertility in spite of the fact that they are perpetually self-fertilised. The discovery of the physical laws behind these facts is imperative, if further progress in the science of heredity is to be hoped for; that in its present condition the science is not in a position to give much help to the breeder of farm animals is sufficiently evident from what has been said. New facts, however, may profoundly modify current views, and lead to discoveries of more economic value. What is wanted is the opportunity and the means to carry out experiments on a large scale, such as would be afforded by the foundation of an institute (on the model of that recently established at Merton through the liberality of the late Mr. John Innes) provided with a staff of experts, both practical and scientific, and liberally endowed with the funds which such expensive investigations necessitate.

WATER SUPPLY IN RELATION TO SMALL HOLDINGS.

CHAS. H. J. CLAYTON, A.M.I.M.E.

A brief consideration of the subject of water supply as applied to small holdings will make it apparent that much of the practical success of the Small Holdings Act is likely to depend upon the manner in which this important subject is treated.

Permanent Ponds.—Districts which would under ordinary

conditions be too hilly to work with less than a full team, as well as those in which surface water is always more abundant than welcome, may be left out of consideration; but if attention is directed generally to average agricultural areas, where the land is either moderately flat or gently undulating, it may be found that permanent ponds are neither so numerous nor so well situated as to make it easy to cut up the land so that each unit shall have its own pond or ponds.

Flat land, if composed of light or sandy soil, absorbs a very large percentage of the annual rainfall by infiltration, whilst that of similar formation, but consisting of heavy soils, has to be well ditched and drained to carry off periodical excesses of rainfall. In either case, the water does not remain in the surface hollows long enough to provide for dry spells.

On an undulating formation, in other than porous soils, ditches must be formed, running roughly parallel with the watershed, in order to prevent the flooding of the fields during storms, and the multiplication of intercepting ditches due to small farming on any considerable scale in such localities will tend to deprive the ponds of some of the water which now finds its way into them. The more permanent ponds, in almost all but clayey districts, are fed from below as well as from above, and in the case of reliable all-the-year-round ponds, such as those found in deep hollows, the surface of the pond-water practically corresponds with the level of saturation of the earth-water surrounding it. Such ponds can afford to lose by evaporation many times their apparent cubic capacity, as such losses as occur are instantly made good by lateral influx; but evaporation does not, in fact, affect these ponds as it affects others, because it is checked by the trees which generally find a congenial home in their vicinity. Any influence, such as the cutting of surface ditches, which tends to prevent infiltration, must, therefore, divert to the ditch outfall some of the water which would otherwise find its way into the ponds by underground channels. This tendency can, however, be corrected either by leading the ditches into the ponds, where that is possible, or by tapping the ditches by means of field drain-pipes.

Artificial Ponds.—Artificial ponds may be formed in favourable situations in open country; but experience goes to show that, except in districts where the rainfall is well above the general average, they are not very successful. One reason is that in order to reach the water-logged subsoil the ponds must be either too deep to be easily accessible to animals, or their sides must be so gradually sloped as to diminish somewhat seriously the cultivable area of the field; then, too, the disposal of the excavated earth over the field is both troublesome and expensive.

In cases where surface-water alone is relied upon for the feeding and replenishment of artificial ponds, as where they are formed in the side of a slope, the prevention of leakage is usually a matter of some difficulty. The presence of land-springs is naturally favourable to the maintenance of artificial ponds, but as land-springs occur only at the overflow points of subterranean reservoirs, a dry winter will generally rob these ponds of their sources of supply.

Pools.—Broads, or pools, formed at selected places, by the widening and deepening of ditches so as to intercept and retain some of the running surface-water, are sometimes successful, chiefly on flat land of heavy character, but these also are liable to failure in dry seasons.

On the whole, it will probably be found that, if each small farm is to be self-contained, reliable natural ponds will be either insufficient in number or inconveniently situated, and that artificial ponds will be both expensive and unsatisfactory.

Streams.—So far, animal needs and trade uses only have been considered, but if we add to these the needs of the households we shall find that surface-water, other than such as is provided by the neighbourhood of pure and permanent hill-streams or large lakes, is unsuitable. Where streams are available, and the portions reserved for animals are carefully guarded against the fouling of up-stream water, human needs may be fairly met, as the stream itself will probably afford sufficient motive power to actuate whatever device (such as a water-wheel, turbine or ram) may be found best suited to the task of propelling the water to where it is needed, or, if

gradients and other conditions are favourable, the stream may be impounded and the water fed to the various water-points by gravitation through pipes. In the case of lakes whose level is not higher than that of the area to be served, borrowed power must, of course, be used for pumping.

Wells.—The most common and dependable source of supply to the average farm is, of course, the well. Now, wells may be broadly divided under two heads, viz., the shallow or "surface" well, which is usually sunk to a depth sufficient to tap the nearest underground water-source, known as a "land-spring"; and the deep well, which is sunk and bored sufficiently deep to reach the more permanent earth reservoirs, called "deep-seated springs." As the land-spring is fed by percolation from the surface, more or less in the immediate neighbourhood in which it is found, it is obvious that the efficiency of the wells which are sunk into it must depend upon the sufficiency of the local rainfall. Deep-seated springs, on the other hand, are fed from the permeable rocks whose outcrops are exposed over wide areas, and whose "dip" may carry them and their contained water at considerable depths beneath many miles of country. It is, then, from porous rocks of the older formations, such as Chalk, Greensand, Oolites, and New Red Sandstone, as distinguished from "drift" and "alluvium," that the more permanent subterranean water supplies are derived, and, however little desirable it may be that the farmer should be at the mercy of the local meteorological conditions for his water supply, it is not rare to find, during a summer which follows upon an exceptionally dry winter, that many farms and other rural dwellings are practically waterless, and that this state of things is the natural sequence of their reliance upon "surface" wells.

Rain-water.—In places where wells are not quite dependable and from which permanent streams are absent, rain-water catchment comes next in importance as a means of supply, but as the water-butt is replenished at the same time and by the same influence as the shallow well both must suffer after a period of drought.

Purity of the Supply.—The average case, then, is one

which cannot be recommended in the matter of dependence upon quantity; and if we go further, and consider the question of quality, much misgiving must be entertained; for it is the commonest experience to find the cow-byre, the stable, the pigstye, the cesspit, or the fowlyard placed in exactly the best positions for well-fouling, and sporadic outbreaks of zymotic disease in rural districts are not uncommonly attributed by medical officers of health to the presence in otherwise pure well-water of organic impurities derived from fouled soil in the immediate neighbourhood. In other ways the rain-water receptacle is equally liable to pollution, for bird-droppings on roofs, decayed plants, and foul gutters serve to promote the growth of micro-organisms, and unless the roofs and gutters are kept clean, and the rain-water is first passed through a separator and afterwards filtered, much risk must be run by those who at times have to rely upon it for domestic use.

Methods of Supply.—Let it be assumed, however, that, pure or otherwise, the well-water is never-failing and that the rain-water tank is above suspicion of shortage. What, then, are the means of drawing the water and conveying it to where it is wanted?

In a good example one would expect to find that the house-supply well was fitted with a horse- or hand-gear pump, discharging into a tank in the roof of the house: that the rain-water collecting-tank overflowed into a filter-fitted service tank, from which the water could be drawn through a tap or syphon pipe, and that the detached farm-service well would be furnished with a hand-windlass and chain for a pair of dipping buckets.

One may omit from consideration the horse-drawn water barrel and the ordinary yoke and buckets, though even under "good" conditions these primitive appliances are very common. It is therefore proposed to show that for each group of holdings of sufficient number (and that number need not be large) a combined system of water supply would be by far the most satisfactory, both on hygienic and economic grounds.

Advantages of a Combined System of Water Supply.—To

begin with the advantages. A combined system in the case of a supply derived from underground sources implies a deep well, the site of which has been chosen upon expert advice; a well deep enough to tap the most prolific water-source underlying the district to be served. Such a well would be provided with a deep-well pump operated by a steam, oil, wind, or suction-gas engine, which would, when not required for pumping, be available for other work, such as threshing, chaff-cutting, churning, root-pulping, &c. From the well the water would be pumped into a covered reservoir or water-tower, placed at a sufficient height above the highest point to be served, to give the necessary "head" for pressure. From the reservoir or tower the water would flow by gravitation through mains, branch mains, and services to the various houses of the group, and also to all other desired water-points for farm service; or, alternatively, the water might be pumped direct to the water-points, and the reservoir be maintained in reserve. Thus the question of sufficiency would be eliminated and the problem of traction resolved.

As to purity, none of the risks present in the case of separate supplies would be likely to affect either the steel-lined well or the iron conduits, whilst the aeration of the water in a properly ventilated reservoir would tend rather to improve its chemical qualities than otherwise.

Estimated Cost of Water Supply.—The next, and in some respects the most important, point is that of cost, and as this question can best be dealt with on comparative lines, two estimates for the complete water supply of a group of holdings having no surface-water have been prepared, the first showing the cost on the separate plan, and the second the cost of a combined installation for the same group, which is hypothetically taken to comprise thirty small holdings within a ring fence enclosing about 1,200 acres of land. The volume requirements of this group, at 320 gallons per unit, would be nearly 10,000 gallons per day.

These estimates are based upon recent experience, and may be accepted as quite reasonable for the purpose of comparison.

As the cost of labour in getting water in the first case may be taken to balance the cost of pumping and attendance

in the second case, nothing has been estimated for maintenance. Interest, depreciation, and sinking fund may for the present purpose also be taken as equal in the two cases.

ESTIMATE NO. 1,

Showing the cost of provision of water-supply to a group of thirty small holdings having no surface-water, each holding to be separately provided in accordance with "good" prevailing conditions :—

FOR EACH HOLDING.

	£	s.	d.
(*a*) One house well, say 4 ft. × 60 ft., wholly or partly steined in brickwork, and protected with oak or stone cover ...	35	0	0
(*b*) One farm well, say 3 ft. × 30 ft., similarly provided... ...	15	0	0
(*c*) One single crank hand-wheel pumping apparatus with 3 in. pump, air-vessel, rods, stages, suction and delivery pipes, &c., to supply tank in roof	29	10	0
(*d*) One galvanised iron 300 gallon house tank with ball valve, overflow, and house service pipe fitted with bib cock ...	8	10	0
(*e*) One 100 gallon galvanised iron collecting rain-water tank and one 300 gallon galvanised iron service tank and rain-water separator	11	0	0
(*f*) One single crank iron windlass with ratchet gear, 2 buckets, and galvanised iron chain for farm well	9	5	0
(*g*) Labour and material in fixing items (*c*), (*d*), (*e*), (*f*)... ...	15	0	0
	£123	5	0
Add 10 per cent. for contingencies	12	7	0
	£135	12	0
Total cost for the group of 30 holdings	**£4,068**	**0**	**0**

ESTIMATE NO. 2,

Showing the cost of provision of a combined system of water-supply to the same group; sixty water-points being provided for :—

	£	s.	d.
(*a*) Deep well, 10 ft. in sump; in brickwork in cement and bored and lined with steel tubes 8 in. and 6 in. in diameter to a total depth of, say, 250 ft.; a 5 in. × 24 in. gun-metal deep well pump 200 ft. down to deliver (at 30 revs.) 2,000 gallons per hour; a 6-b.h.p. oil engine in brick built and slated engine house, and all necessary fittings ready for use...	575	0	0
(*b*) One circular domed reservoir either of brickwork in cement or ferro-concrete, with valves, washout, ventilator, float indicator, iron ladder, manhole, &c., total capacity 60,000 gallons,* complete and ready for use. (A water tower of similar capacity would cost about twice this amount)	250	0	0
(*c*) Mains and fittings, say, 1 mile 3 in.; 1 mile 2½-in. hydraulic main, and 4 miles 1½-in. and smaller branch mains and services in plough and frost-proof trenches, with all necessary sluice and air valves in brick pits, surface boxes, frost cocks, house fittings, and draw taps on farm stand-pipes complete and ready for use	1,700	0	0
	£2,525	0	0
Add 10 per cent. for contingencies	253	0	0
Total cost for the group of 30 holdings	**£2,778**	**0**	**0**

* This provides for a reserve supply equal to six days' requirements.

It has been said that local conditions will vary considerably. It may, therefore, be fair to assume that, instead of the waterless groups which have just been considered, we have to deal with a somewhat similar aggregation of farms which are, however, sufficiently provided with surface-water to meet the needs of animals, but from which potable water is absent.

For the purpose of comparison, Estimates Nos. 1 and 2 may be in that case modified as follows:—

By striking out from Estimate No. 1 items (*b*), (*f*), and part of item (*g*) we reduce the expenditure on the thirty farms by £883, thus bringing down the total cost to £3,185.

All the items of Estimate No. 2 are reducible under the contracted requirements, and in this case £658 may be struck off, which leaves the total standing at £2,120.

These estimates show, therefore, that there would be an initial saving of over £1,000 in favour of a combined system, whether animal requirements had to be provided for or otherwise. They also show that the cost of a combined system "all in" is appreciably less than that of a separate system for domestic supply only.

Against them, there ought, perhaps, to be placed the interest which might be saved in the case of groups which developed very gradually, and where the holdings were separately equipped as they were taken up, in which event the whole capital cost of water equipment would not, of course, be needed at the outset; but the economy of future extensions of a combined system to meet other possible requirements may very well be taken to cancel this item, as similar extensions of a separate system would probably be in the direction of the more expensive provision of additional wells.

As regards the cost of supplies from sources other than those which have been considered, no reasonable estimate can be made, except in connection with concrete cases—*e.g.*, the cost of impounding a stream for the supply of the group herein assumed, and of providing compensation water for those entitled to it, would necessarily depend upon a number and variety of circumstances which it would be useless to try to imagine. Similarly, the cost of taking a supply, by means of rams or other hydraulic machinery, from a running stream

could only be estimated upon a statement of the main conditions obtaining in each case.

As, however, something of the success of small holdings will depend upon the manner in which the subject of water supply is treated, it may be urged that full consideration should be given in the case of each group to the possibility of providing, with all due regard to economy, a system which will not only justify a business-like dependence upon its efficiency but also admit of future expansion as occasion may require without unnecessary multiplication of its essential parts.

Tomato and Potato Bacteriosis.

This disease has been known for some time in the United States, where it has been carefully studied by Dr. Erwin F. Smith. The organism concerned is called *Bacillus solanacearum,* E. F. Smith. Potatoes, tomatoes, and egg-plants are attacked, sometimes on a large scale, in America. In this country it was first observed in 1902 (*Jour. Bd. Agric.*, IX., p. 308) in small quantity on potatoes grown in the North of England and in Scotland. During the present season the same disease has attacked tomatoes to a somewhat serious extent, examples having been received at Kew from two localities, where it is stated to be present in an epidemic condition.

The symptoms indicating the presence of the disease on tomatoes are well marked. Infection usually takes place at or near the tip of the stem, the disease gradually working downwards, passing into the leaves and flowering shoots as it does so, until the root is reached. Shortly after infection the uppermost leaves commence to wilt, curl and turn yellow. The leaves become marked with many rather small, scattered, blackish-brown blotches, and long dark-brown streaks appear on the surface of the stem. If the stem be cut across, the vascular bundles or woody portion present a brown appearance, and on microscopic examination the vessels are found to be teeming with bacteria. The fruit also becomes more or less covered with dark-coloured blotches, which at first are quite superficial, but gradually increase in size and assume a watery consistence, finally collapsing and forming irregular pits on the surface of the fruit. After the spots on the fruit, which are at first crowded with bacteria, have collapsed,

various kinds of fungi and bacteria gain an entrance through the broken fruit, which is speedily reduced to pulp. Diseased plants gradually droop and die from the top downwards.

In potatoes the symptoms are somewhat similar to those described above. The uppermost leaves droop first, and the stem becomes very conspicuously marked with blackish longitudinal streaks. The vascular bundles are also browned, owing to the presence of the bacterium, which travels along the vessels of the underground branches and passes into the tubers, where its presence is indicated by a more or less decided brown ring situated a small distance from the outside of the tuber, and corresponding to the position of the vascular-bundle ring of the tuber. As an infected tuber increases in size the bacteria encroach on the central mass enclosed by the vascular ring, which gradually assumes a brown colour, and finally becomes soft and rotten, leaving a thin outside crust intact. This shell is usually broken when the potatoes are lifted, and its contents, swarming with bacteria, remain in the land.

In the case of potatoes, Dr. Smith has shown that the rapid spread of the disease is caused by insects of various kinds, feeding alternately on diseased and healthy plants. The numerous isolated patches of disease on the fruit and leaves of the tomatoes examined at Kew support this view. To prevent this the plants should be sprayed with Bordeaux mixture containing an insecticide, which would answer the double purpose of warding off insects and preventing the appearance of *Phytophthora infestans, Cladosporium fulvum*, &c.

Bacteria have occurred abundantly in the substance of partly ripe tomatoes; hence, owing to the difficulty experienced in thoroughly removing the glairy coating from the seed, it is highly probable that bacteria would become locked up in this substance as it dried round the seed, and on being released during germination would endanger the crop. Seed obtained from fruit grown in an infected area should not be used.

Potato tubers showing the slightest trace of an internal brown ring should not be used for "sets"; in fact, potatoes from an infected district should be avoided.

BACTERIOSIS OF TOMATO PLANT (*Bacillus solanacearum*).

Soil that has produced a diseased crop should be treated with gas-lime or with superphosphate of lime.

Notes on Insect, Fungus and other Pests.

The Pear Leaf Blister Mite, to which attention was drawn in the issue of the *Journal* for June, 1909, has been notified to the Board from several districts. The owner at Hunstanton referred to in that number has recorded the reappearance of the pest in spite of all precautions, and the affected tree is to be destroyed. Fortunately, the other trees in the garden have not been attacked. On the other hand, the trees reported last year at Harpenden are said to have been cured by the remedies adopted, viz., washing with caustic soda, lime, and sulphur, and picking the diseased leaves. Cases were also recorded from Hythe, and Cumbrae in Scotland. In no case was the pest present on many trees.

Last year a correspondent from Worthing reported an attack on his apple-trees by a tiny green caterpillar, which turned brown later in the season. It had also occurred the year before. The moths in July, 1909, were flying "in thousands" about the trees. The caterpillar proved to be *Melanthia bicolorata* or *rubiginata*, one of the Geometridæ. It feeds on many plants, but has never been recorded as doing so much damage as was described. This year the pest has reappeared, but the drastic remedy adopted last year, viz., that of cutting down the trees, has prevented the attack from being serious. In this, as in many other cases brought to the notice of the Board, the caterpillar of the moth *Tortrix heparana* was present, apparently doing considerable damage.

Frit-fly was recorded in Bicester, Oxon, on June 20th. The oats were sown after mangolds last year. Wheat Bulb-fly was reported from March, in the Isle of Ely. According to the writer, "it seems to be worst after a bad crop of potatoes or mangolds." Several cases of attack of Mangold-fly (Leaflet No. 5) have been reported from Beverley, and Brough, in East Yorkshire, among others. In some cases the damage is reported as extensive. The Board are also informed that there have been many complaints from South-East Lancashire as to the damage done by the same fly. In the same district the caterpillars of the Common Ghost Swift Moth

(*Hepialus humuli*) did considerable damage to a field of oats about the beginning of the month.

A number of non-injurious insects were sent up for identification. A lacewing-fly, *Chrysopa flavifrons,* was sent from Ross, in Herefordshire. The larvæ of this fly, as is well known, feed on green-fly. Specimens of *Seoptera vibrans,* a fly of the family Ortalidæ, were sent from Stoke-by-Nayland, Colchester. Little is known of the habits or metamorphosis of these flies, but there is no record of any injury to vegetation which could be attributed to them. Their relationship to the Asparagus-fly does not prove that they are injurious. Several specimens of St. Mark's fly, *Bibio marci,* have been sent from Stroud, Gloucestershire. These flies, which often arouse suspicion and even alarm, owing to their appearance in numbers, are harmless in the adult flying stage.

Apple Mildew (Leaflet 204) was reported as abundant near St. Columb, Cornwall, and from East Dulwich. In both these cases, as well as in several others reported from different parts of England, the blossom and leaves on part of the trees withered suddenly and without any apparent cause. Frost was suspected in some cases, but in others the phenomenon was recorded in comparatively mild weather. In one or two of the cases Apple Sucker was discovered, but by no means in all, and it would seem that loss has been caused by some pest which is present in numbers though irregularly distributed.

The fungus *Phyllosticta prunicola,* Sacc., was found at Feltham and at Earl Soham, Suffolk. Cox's Orange Pippin and Wellington were said to be almost the only trees attacked, but these have been very seriously injured during the past three years. This fungus is not very destructive except when present to a great extent on the leaves, when spraying with dilute Bordeaux is recommended. It has a superficial resemblance to Shot-hole Fungus (*Jour.*, June, 1910, p. 211).

American Gooseberry Mildew was reported in the summer stage on May 12th, or two days earlier than in previous years. It has appeared with great intensity on the berries in certain districts where the Board's requirements had not been properly carried out in the autumn; but in other places, where the pruning had been systematically carried out, the amount of disease is appreciably less than in previous years. Certain pustular

FIG. 18.—BULBOUS AGARIC

(*Amanita mappa*).

outgrowths on a gooseberry bush in Wilburton, Isle of Ely, were ascribed to *Nectria ribis,* Neissl.

A suspected case of *Mycosphaerella citrullina* on tomatoes was reported from Norfolk, but the evidence was not conclusive. A well-marked case on cucumber, however, was reported from Wigton, in Cumberland. As described by the owner, "a plant can be strong in the morning and withered down at night." The matter is being further investigated. Meanwhile, the interest aroused has led to a number of cases being submitted to the Board for identification, and in several instances other diseases have been found. Thus in Acle, Norfolk, *Fusarium lycopersici,* Sacc., was detected. From Lingwood, Norfolk, *Fusarium lycopersici* on the stem, and *Cladosporium epiphyllum,* Mart., on the leaves. In Monmouth a bad case of *Bacteriosis solanacearum,* E. F. Smith, was confirmed. This disease is dealt with at length at p. 297. *Cladosporium epiphyllum* was found in potato-leaves at Shrewsbury. Corky Scab was reported from Elie, Fife.

Sphærella tabifica in mangolds was reported from Long Niddry, East Lothian.

A very severe attack of disease on celery was reported from the neighbourhood of Boston. The owner sent up for examination a dozen plants all cankered at the roots, with a letter stating that he had thousands more, which, though apparently healthy and well grown, succumbed to the touch when an attempt was made to take them up. The main disease present was *Sclerotinia sclerotiorum,* Mass. (Leaflet 127), but Celery Leaf Spot, *Phyllosticta apii,* Hds., dealt with in the *Journal* for March, 1910, was also present. The amount of disease reported suggests the thorough infection of the soil, which would need sterilising before celery plants are grown there again.

POISONOUS VARIETIES OF FUNGI.*

BULBOUS AGARIC (*Amanita mappa.* FIG. 18).

The cap is convex at first, becoming flat, smooth, dry, whitish or tinged with yellow, often with a few irregular

* The previous numbers of this series of coloured plates and descriptions have appeared in the *Journal* as follows:—Nos. 1–3, February, 1910; Nos. 4–6, March, 1910; No. 7, February, 1909; Nos. 8–10, April, 1910; Nos. 11–13, May, 1910; Nos. 14–16, June, 1910; No. 17, September, 1908.

patches which are easily rubbed off, 3 to 4 inches across; gills crowded, clear white; stem white, short, cylindrical, with a torn ring or frill, base bulbous, having the remains of the sheath or volva attached to its upper margin.

It occurs on the ground in woods during autumn.

It has a strong, unpleasant smell, and is very poisonous.

WARTED AGARIC (*Amanita pantherina*. FIG. 19.)

The cap is convex, becoming almost or quite flat, edge grooved, dusky brown or reddish-yellow, flesh persistently white, 3 to 4 inches across; gills white, unchangeable; stem elongated, whitish, ring present, base bulbous, volva attached to the bulb, its margin only free.

It is found in woods and in pastures under trees in autumn.

The sheathed agaric differs in the absence of a ring or frill on the stem, and in the base of the stem not being bulbous. The Warty caps (*Amanita rubescens*, Fig. 6—see *Journal*, March, 1910) is readily separated from this species by the flesh of the cap and stem becoming tinged reddish-brown when cut.

Report on Small Holdings and Allotments.

The Board of Agriculture and Fisheries have published the Report of the Small Holdings Commissioners on the proceedings of the Board during 1909 under the Small Holdings and Allotments Acts. Part I. of the Report [Cd. 5180, price 10½*d*.] deals with small holdings, and Part II. [Cd. 5188, price 9*d*.] with allotments, and with certain others Acts administered in the Land Division.

Considerable progress has been made during the past year in satisfying the demand for small holdings, and the position on the 31st December last was that 60,889 acres had been actually acquired or agreed to be acquired for small holdings by County Councils in England and Wales, of which 34,234 acres had been purchased for £1,107,215, and 26,655 acres leased for rents amounting to £33,611. Of this land vacant possession had been obtained of 38,126 acres, and 36,845 acres had been actually let to 2,793 individual small holders, and 28 acres sold to two small holders. In addition 2,674 acres had been let or arranged to be let to 17 Co-operative Small Holdings Associations, who had sub-

FIG. 19.—WARTED AGARIC
(*Amanita pantherina*).

let the land to their members, and 1,648 applicants had been provided with over 20,000 acres by private landowners direct, mainly through the instrumentality of the Councils. The land which has been acquired but not yet allotted will probably provide for another 2,000 applicants, so that assuming that the Associations have sublet their land to not fewer than 200 tenants, which is a moderate estimate, it will be seen that the Act has resulted in the provision of land for approximately 6,600 applicants in two years.

During 1909 3,598 fresh applications were received by County Councils for 63,523 acres, bringing the total number of applicants since the Act came into operation up to 26,883, and the total quantity of land applied for up to 437,124 acres. Of these applicants 15,191 had been provisionally approved for 216,863 acres up to the end of 1909.

After describing the steps taken during 1909 in administering the Act, the Commissioners make the following observations as to the progress which has been made in providing small holdings:—

"The experience of the two years during which the Act has been in operation is sufficient to justify us in saying that there is undoubtedly in most parts of the country a widespread demand for small holdings from men, many of whom are thoroughly well qualified by knowledge and experience, and who have sufficient capital to work them profitably. It is true that hopes have sometimes been encouraged which have proved impossible of realisation, but the majority of the applicants now understand that they cannot expect, as a matter of course, to have the particular land they have set their hearts on, and that they will, as a rule, have to pay more rent per acre than is commonly charged for large farms. We regard the progress that has been made by County Councils in satisfying the genuine demand as on the whole very satisfactory, and we think that in the great majority of cases there is no justification whatever for the view that hostility or apathy exists on the part of those responsible for the administration of the Act.

"We believe also that the great majority of the schemes which are now in working order will prove successful, and that, although the cultivation of land is not the gold mine that is sometimes supposed, the tenants of the small holdings

will be in a better position both financially and socially than they were before the passing of the Act."

A number of interesting reports are given on some of the small holdings already established, together with particulars as to the provision of small holdings in each county.

In the Report on Allotments it is stated that the total quantity of land held for the purpose of allotments by the various Local Authorities in England and Wales on the 31st December, 1909, was 26,764 acres, of which 5,687 acres were the property of the Councils, and 21,077 acres were leased. This land is let to 90,550 individual tenants, 21 Associations, and 1 Committee.

The number of applications received for allotments in 1909 was 16,996, the total quantity applied for being 6,048 acres; 2,407 acres were acquired, as compared with 1,253 acres in 1908, and 5,818 individual applicants and 9 Associations were provided with allotments by Local Authorities, in addition to a large number of applicants who were provided with allotments on land previously acquired.

The Action of Cold on Plants.

The action of cold on plants varies not only with the nature of the plants themselves, but also in accordance with certain little-understood changes which take place in their cell-contents. The theory which has in the past been accepted as explaining the death of plants from cold was based on the rupture of the cell through expansion and contraction due to changes in temperature. When the tissues of higher plants are frozen, films of pure ice form on the walls abutting on intercelluar spaces, and these films grow steadily to quite large lumps of ice, causing disruption of the tissues. Muller-Thurgau and Molisch held that the fatal effect of freezing was to be traced to the resulting dessication of the protoplasm whereby its structure was irrecoverably disorganised. It was thought that it was only on the thawing of the cell that the fatal disorganisation set in, and that if the thawing proceeded very slowly recovery might take place, although if the change of temperature were sudden and the thawing rapid, recovery would be impossible. Experiments, however, demonstrated the incorrectness of this view,

and investigations by Lidforss, a Swedish botanist, have suggested an explanation which appears to account for certain phenomena which were previously inexplicable, *e.g.*, the effects of late spring frosts in comparison with more severe frosts earlier in the season, and the reason for the beneficial effect of "hardening off" plants raised under glass.

The work of Lidforss in this direction is described in Die Wintergrune Flora (*Lunds Univ. Arsskrift,* Bd. II., No. 13, 1907), which is reviewed by Mr. F. F. Blackman in *The New Phytologist* (Vol. VIII., Nos. 9 and 10). The investigations were made on the plants which remain green through the winter in South Sweden, and established one general characteristic of all these plants which appears to protect them from the effects of frost. This is that all winter-green leaves are quite free from starch, but contain quantities of sugar and sometimes of oil in the mesophyll. In the summer these same leaves contain starch, which is in the spring regenerated from the sugar.

The presence of this sugar in the cells has been shown to enable the plants to survive a lower temperature, and, according to Lidforss, the conversion of sugar into starch explains why it is that a plant which has survived the profound and prolonged cold of winter may be killed by a sharp night frost in early spring, especially when the night frost is preceded by a spell of bright sunny radiation. A succession of warm days in spring causes the disappearance of the protective sugar and the regeneration of starch in the plant, and it is this that makes the plant susceptible to cold. This theory is borne out by the observation that it is the well-sunned south side of evergreen trees like *Ilex* and *Taxus* that suffer in such weather, and that here the sugar has gone, while the shaded north side of the tree still keeps its sugar and is uninjured by the spring frost.

Time of Cutting Lucerne.

Lucerne is usually cut for hay or green fodder just before coming into flower. An American correspondent, Mr. Joseph E. Wing, has pointed out that lucerne should never be cut before certain small shoots or buds have appeared at the base of the stems near the surface of the ground. If it is mown off before these shoots appear,

the plants will be weakened and the succeeding crop much diminished. Mr. Wing states that he has observed the ill-effects of cutting lucerne too early in England, and suggests that the lucerne ought to be cut as soon as the shoots or buds appear without regard to the flowering of the plant.

With reference to this point, Mr. Martin H. Sutton informs the Board that experiments made by him for many years have shown the statement to be perfectly correct so far as the first season of growth is concerned. Lucerne should never be cut until the first buds have formed at the base of the plant, as if the crop is cut too soon the result is a definite retarding of growth. This, however, is only found to apply to the first year. After the first year the plant is well established; no ill-effects have been noticed from cutting early. When once the plants are well established new buds are forming almost continuously, and there is, therefore, no risk in cutting early in the second and succeeding years.

Value of Chalk as a Dressing for Light Soils.

Observations on the agricultural value of chalk, with special reference to particular kinds of soil requiring lime in a mild form, have recently been made by Mr. John Hughes, Agricultural Analyst for Herefordshire. Chalk is but slightly soluble in cold distilled water—very much less so than caustic lime. It was found that while 1 part of caustic lime dissolves in 833 parts of water, 1 part of chalk only dissolves in 22,222 parts of water—the relative solubility being, therefore, about as 1 to 27. Under soil conditions, however, the solvent is not pure water, but "soil water," which contains various vegetable acids exerting a considerable solvent action on plant foods. It is usual, therefore, to make comparisons by the use in chemical practice of a 2 per cent. solution of citric acid, originally suggested by Wagner as a standard solvent for estimating the probable availability of phosphate of lime in basic slag. Such a solution, however, is far stronger than the sap acidity of plants, and in order that an acidity or solvent action less than that possessed by the sap of farm crops should be represented, Mr. Hughes tried a 0·1 per cent. solution of citric acid. With such a solution he found that 1 part of caustic lime was dis-

solved in 809 parts of the solution, while 1 part of chalk was dissolved in 984 parts. Comparing the actual lime in quicklime with that in chalk, it appears that in pure cold water caustic lime is about 27 times more soluble than chalk, but that in the 0·1 per cent. solution of citric acid lime in caustic lime is only about twice as soluble as the lime in the form of chalk.

It seems clear, therefore, that if chalk be reduced by grinding to as fine a condition as caustic lime, it will be sufficient to apply 1 ton per acre of ground chalk instead of 10 cwt. per acre of ground lime. The ground chalk would usually be both less costly than ground lime, and more convenient to apply. At the same time it would have a less rapid action in the destruction of vegetable matter in the soil. Mr. Hughes remarks that the value of chalk for all light soils has been too much neglected. The red soils of Worcester and Hereford are, he says, types of soils that would be improved by dressings of finely-ground chalk, which is also suitable for gravel, granite, and sandy soils deficient in vegetable matter as well as in lime. The chalk should be dried and ground finely, distributed evenly, and lightly harrowed in.

Poisoning of Cattle by Sheep-dip Paste.

The attention of the Board has recently been called to a case of poisoning of cattle which resulted in the death of three heifers. Soy bean cake was being used as a feeding stuff, and it was at first suggested by the owner of the animals that this might have contained some deleterious substance. Careful examination of samples of the consignment of soy bean cake failed to reveal anything likely to have been injurious, but a portion of the food which was actually being fed to the animals which died was fortunately preserved, and a sample of this was found to contain, in addition to pieces of cake, a yellow ball of material weighing about 1 oz., which corresponded in composition with arsenic sheep-dip paste. The whole sample, weighing about 17 oz., was found to contain 138 grains of white arsenic, whereas 10 grains are recognised as a fatal dose for a cow.

Further investigation showed that an empty keg of sheep-dip paste had been left apparently for several years near to the cake-breaking machine, and there seemed little doubt

that on this occasion this keg had been used to convey some of the broken cake to the cattle. The keg probably contained small portions of the paste, which thus became mixed with the food, and resulted in the death of the cattle.

Arsenic sheep-dip paste is a highly poisonous material, and farmers should be careful to see that empty tins or kegs are not used for any purpose.

Afforestation on the Inverliever Estate.

The Board have been furnished by the Commissioners of H.M. Woods and Forests with the following statement as to the progress of the work of afforestation on the Inverliever Estate. This estate, it will be remembered, has been purchased for the purpose of carrying out a scheme of afforestation in Scotland on scientific and economic lines (*Journal,* 1909, pp. 219, 980).

During the past year a block of about 400 acres was enclosed with a sheep and cattle fence. The draining of the area to be planted during the year was completed, and on parts of it on which the bracken growth was very vigorous this was cut twice and in places three times. The winter was unusually severe, and planting was very much retarded, yet by the end of May, 1910, about 190 acres were planted up with the following:—171,000 Larch, 120,000 Scots Pine, 283,000 Spruce, 45,000 Silver Fir, 35,000 Douglas Fir, and 20,000 Sitka Spruce. Of these, 590,000 plants were purchased, and the balance was taken from the Nursery at Ford. Unfortunately, in spite of the steps taken to keep them down, hares and rabbits did serious damage during the hard weather, and next season some of the area nearest the lake will have to be replanted, and protection afforded by wire-netting where necessary. Black game also have done some damage.

In the Nursery at Ford another part was taken in hand, cultivated, cleared of large stones, and partially cleaned. As noted above, over 80,000 plants were taken from the Nursery and planted out. This season the following seedlings were purchased and have been lined out:—90,000 Larch, 200,000 Scots Pine, 200,000 Spruce, 20,000 Sitka Spruce, 10,000 Douglas Fir and 10,000 Silver Fir. They are looking fairly

well. In addition, seed of the following species has been bought and sown :—Larch (native and Tyrolese), Scots Pine, Spruce, Sitka Spruce, Douglas Fir, Silver Fir, *Tsuga Mertensiana* (*Albertiana*), *Abies grandis, Thuja gigantea, Sequoia gigantea,* and *Cupressus macrocarpa.* The germination, with the exception of the native Larch, is fair.

At the request of the West of Scotland Agricultural College, four experimental plots, each divided into six sections containing different species, have been set apart and treated with different artificial manures. The object is to test the effect of these upon the growth of the plants.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

EXPERIMENTS WITH ROOT CROPS—*continued.*

Varieties of Swedes (*Midland Agric. and Dairy Coll., Bull.* 8, 1909-10).—This report gives the results of the trials of swedes in 1909, the third year of the experiment. Ten varieties, mostly Bronze Tops, were grown at six farms, the cultivation and manuring being in each case that adopted by the farmer for the rest of his crop. The weather was sunless, and the crops made slow growth. Finger-and-toe caused a partial failure at some of the centres, and the results from three centres only are used in finding the average yields of the varieties. In this year no one variety showed special merit, but most of them gave satisfactory results. Taking the average of the three centres, eight varieties gave about 20 tons per acre, viz. :—Carboy, X.L. All, Magnum Bonum, Model, New Empire, Nailstone, Invicta, and Golden Melon. The yield of Improved Purple Top and Darlington was rather less. The percentage of dry matter in the roots was ascertained, and in this also the varieties were fairly equal. Nine had about $8\frac{1}{2}$ per cent., and one, Improved Purple Top, slightly over 9 per cent.

At two of the centres the roots were stored in "clamps." The results showed that harm may be done by covering the roots too thickly in the clamp, thus causing a lack of aeration and considerable heating and rotting. At one centre, where the roots were covered with straw only, there were very few bad roots, whereas at the other, where they had a thick covering of soil in addition to straw, there was a large percentage of rotten roots. At both experimental centres the variety with the highest percentage of bad roots was Golden Melon, which has the reputation, in parts of Lincolnshire, of being an excellent keeper. This is probably true only when the roots are left growing in the

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* The summaries of agricultural experiments which have appeared in the present volume have been as follows :—Cereals, April ; Cereals and Root Crops, May ; Root Crops, June. The Board would be glad to receive for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

field, where its abundance of top may tend to protect it in the case of severe frosts.

Manuring of Mangolds (*Midland Agric. and Dairy Coll., Bull.* 5, 1909–10).—In experiments during the five years 1903–7 the following dressing of artificials, applied in addition to the ordinary supply of farmyard manure, was found to be the most profitable for mangolds :— Sulphate of ammonia, 100 lb. (at seeding); nitrate of soda, 130 lb. (at singling); superphosphate, 750 lb. (at seeding); sulphate of potash, 120 lb. (at seeding); common salt, 280 lb. (in March). This "standard dressing" is now being tested for five years against various modifications of it. In 1908 the trials were made on ten farms, and in 1909 on eight. Both years, however, were unfavourable to mangolds, and the results on only three farms in 1908 and six in 1909 are considered reliable. At these centres, from 15 to 20 tons per acre of farmyard manure were applied. The addition of the standard dressing mentioned above, costing 55*s*. 6*d*. per acre, resulted in a profit of 11*s*. 5*d*. per acre over the cost of the dressing. Modifications of it, by leaving out the whole or part of some of the constituents, resulted in a loss, except in two cases. Where the full amount of sulphate of ammonia and nitrate of soda contained in the standard dressing was applied alone, there was a smaller total crop, but the balance of profit, after paying for the manure, amounted to 10*s*. 1*d*. The application of the nitrogen and potash in the standard dressing, but omitting the superphosphate, also rather more than covered the cost of the manure.

Manuring of Mangolds and Swedes (*Devon County Agric. Com., Rept. on Field Expts.*, 1907–9).—Experiments in manuring mangolds were carried out at five centres in Devonshire. On a light sandy soil, deficient in lime, phosphate, and potash, at Higher Beer, Filleigh, and East Rowley, Romansleigh, the best results were given by a complete manure composed of 4 cwt. kainit, 1 cwt. sulphate of ammonia, 1 cwt. nitrate of soda, and 528 lb. superphosphate. These manures are recommended for this class of land, which covers a wide area of North Devon. At the former place, farmyard manure was used, and the most profitable system of manuring was 15 tons of farmyard manure with a moderate dressing of artificials, the dressing mentioned above being used with only half the quantity of the sulphate of ammonia, nitrate of soda, and superphosphate.

At Branscombe, where the soil was a clay loam with flints, the results were similar, but 1½ cwt. of sulphate of potash was more effective than the kainit. A complete dressing of artificials, with or without farmyard manure, is indicated for this soil.

At Budlake, Broadclyst, the soil was a good loam. Twelve tons of farmyard manure and 4 cwt. of kainit were applied in early spring. The crop produced by this was 33 tons per acre, and on this rich soil little increase was obtained by adding any further manures.

At Mortehoe, on a light loam deficient in phosphates and potash and not rich in nitrogen, a complete manure was required to produce a full crop. With no manure, the yield was 15 tons 10 cwt.; 15 tons of farmyard manure increased this to 30 tons 15 cwt., and a further increase to 46 tons 4 cwt. was given by the addition of 3 cwt. basic slag, 28 lb. nitrate of soda, and 4 cwt. kainit at seeding, and 28 lb. nitrate of soda after singling. When no farmyard manure was used

an almost equally good result was produced by 1 cwt. sulphate of ammonia, 528 lb. superphosphate (33 per cent. soluble), 160 lb. sulphate of potash, and 128 lb. nitrate of soda, the crop being 43 tons per acre.

An experiment on the manuring of swedes was carried out at Culmjohn, Rewe, on a medium loam soil. The whole of the field was treated with farmyard manure produced by fattening bullocks, and the addition of artificial fertilisers to this had but little effect.

The value of calcium cyanamide for turnips was tested on four plots. A mixture of 300 lb. superphosphate with 56 lb. calcium cyanamide yielded 16 tons per acre; the same quantities of superphosphate and sulphate of ammonia yielded 13 tons; 400 lb. of basic slag and 56 lb. calcium cyanamide produced rather less than 13 tons.

Feeding Value of Turnips manured with Basic Slag (*Devon Agric. Com., Report on Field Expts.*, 1907–8).—An experiment was arranged to determine whether the results obtained in Scotland, showing a superior feeding value for slag-grown swedes, would be confirmed in this county. Two half-acres of land were dressed with ¾ cwt. sulphate of ammonia per acre, and one with 6 cwt. superphosphate (25 per cent. soluble) per acre, the other with 6 cwt. basic slag (26·3 per cent. phosphate) per acre. The soil was deficient in lime, but had been dressed with ground lime at the rate of half a ton per acre in January, 1909. This liming would make the difference between the acid superphosphate and the basic slag less important. The crops, which were practically equal on the two plots, were fed to sheep, and fifteen sheep fed for five weeks on the slag-grown swedes made a total live weight increase of 80 lb., while fifteen fed on the superphosphate-grown swedes made 64 lb. The former roots suffered less from finger-and-toe, and were eaten by the sheep with more relish.

Manuring of Mangolds (*Rothamsted Expt. Stat., Report*, 1909).—Mangolds have been grown on the Barn Field with the same systems of manuring since 1876, and this report gives the yields obtained in 1909. The yield was generally above the average, especially on the plots receiving dung or rape cake. The usual fungoid attack of *Uromyces betæ* on the plots receiving an excess of nitrogen was not so prominent this year.

EXPERIMENTS WITH POTATOES.

Experiments with "Seed" Potatoes (*Univ. Coll. of N. Wales, Bangor, Bulls.* 9 *and* 10, 1909).—An experiment to show the effect of change of "seed" was carried out by former students of the College in fifteen different districts. There were two plots at each place, Plot 1 being planted with seed fresh from Scotland, and Plot 2 with seed grown on the farm, in most cases for two years. The Up-to-date variety was planted in every instance.

On the average the new seed produced nearly 2 tons per acre more marketable potatoes than that which had been previously grown on the farms. It is concluded from this that the "seed" should be changed every year, or at the most every other year.

In 1908 and 1909 a series of experiments was begun with "seed" obtained from various parts of the country, with the view of elucidating

the widely different results given by "seed" of the same variety from different districts. The weights of the crops in those years are given.

An experiment to compare the crop from "seed" of different sizes and from cut sets has been carried out during the last three years. Three sizes of seed were used, viz. :—(1) seed dressed over a $1\frac{1}{4}$ in. and through a $1\frac{5}{8}$ in. riddle; quantity required to plant an acre, 18 cwt.; (2) seed dressed over a $1\frac{5}{8}$ in. and through a $2\frac{1}{2}$ in. riddle; quantity required to plant an acre, 1 ton 11 cwt. 98 lb.; (3) cut seed; quantity required to plant an acre, 18 cwt. 42 lb. The "sets" were in all cases placed 14 in. apart in the rows, so that approximately the same number of sets was planted in each plot.

The weight of marketable potatoes per acre produced by each, taking the average of the three years, was :—Small seed, 11 tons 1 cwt.; large seed, 13 tons; cut seed, 12 tons 5 cwt.

An experiment on the effect of planting potatoes at different distances apart in the rows was also made for the third time in 1909. The potatoes were passed over a $1\frac{1}{4}$ in. and through a $1\frac{5}{8}$ in. riddle, and were planted at distances of 12, 15, and 18 in. apart in the rows. The rows were 26 in. apart in 1907, and 28 in. in 1908 and 1909. The average crops of marketable potatoes per acre were as follows :—Planted 12 in. apart, 13 tons 7 cwt.; 15 in. apart, 13 tons 5 cwt.; 18 in. apart 11 tons 19 cwt. It seems fairly evident from the results of each year as well as from the averages that there is a loss of yield from planting potatoes as far apart in the rows as 18 in.

The loss of weight that may be expected to take place in potatoes stored during the winter was tested. Four tons of potatoes were sorted and stored on November 1st in a pit covered with straw and soil in the usual way. On March 19th the potatoes were taken from the pit and weighed, with the following result :—Good potatoes, 3 tons 10 cwt. 72 lb.; bad potatoes, 7 cwt. 76 lb.; the loss of weight, apart from decay and disease, being 1 cwt. 76 lb. This would probably be much greater if the potatoes were stored in any other way than in pits. The loss from disease will always vary with the season.

Varieties of Potatoes (*Univ. Coll. of N. Wales, Bangor, Bull.* 12, 1909).—Sixteen varieties of potatoes were grown in 1909. The varieties of the Up-to-Date type, many of which are very much alike, were by far the best croppers. Northern Star did not yield so well as many of the others, but was practically free from disease, and kept its condition well when stored. The best yields, excluding diseased potatoes, were given by Dalhousie, 20 tons 18 cwt.; Dalmeny Beauty, 20 tons 8 cwt.; Up-to-Date, 19 tons 16 cwt.; and Mayfield Blossom, 19 tons 14 cwt. A report on the cooking quality of each variety is given in the report, and of the four mentioned Dalmeny Beauty appeared to be the best in this respect.

Manuring of Potatoes (*Univ. Coll. of N. Wales, Bangor, Bull.* 3, 1909).—This experiment has been carried out on six farms in North Wales in 1908 and 1909, and the average results for the two years are given. The crop of marketable potatoes without manure was 4 tons 13 cwt. Ten tons of farmyard manure per acre produced an increase of nearly 3 tons per acre, while an additional 10 tons produced a further increase of 23 cwt. per acre, which would not pay the cost of the extra manuring. When a dressing (which cost 52*s*.) of 202 lb.

sulphate of ammonia, 524 lb. superphosphate, and 164 lb. sulphate of potash per acre was applied in addition to 10 tons of farmyard manure, the yield was more than $2\frac{1}{2}$ tons greater than with the farmyard manure alone. The effect was tried of leaving out each of the three constituents of the dressing of artificials. The complete manure gave the largest yield, though the differences were not great.

Effect of Maturity on Seed Potatoes (*Midland Agric. College, Bull.* 6, 1909–10).—Seed lifted at three different dates was tested at two centres, but no very conclusive results were obtained.

Trials of Varieties of Potatoes (*Monmouthshire Agric. Educ. Com., Potato Trials,* 1909).—Trials with a very large number of varieties were carried out at Llanfair in 1909, and the weights produced from eighteen selected sets are given, together with the results of a cooking test.

Manuring of Potatoes (*Roy. Agric. Coll., Scientific Bull. No.* 1, 1909).—Manurial trials were carried out in 1909 on duplicate plots, which were planted with Scotch and Irish seed. There was no marked difference in the yields of the two classes of seed. As regards the effect of the manures, the addition of non-nitrogenous manures alone produced no increase in yield. Nitrate of lime and superphosphate gave an increase of 36 cwt. over the unmanured plot, or, with potash, 53 cwt. The best yield, however, was obtained when sulphate of ammonia was substituted for the nitrate of lime, the complete dressing then yielding an increase of $4\frac{1}{2}$ tons.

Scotch and Irish Seed (*Univ. Coll., Reading, Results of Expts. at the College Farm,* 1909).—Most farmers in the Midlands and South of England agree that seed potatoes from Scotland produce better crops of tubers than sets of the same variety obtained from a locally grown crop of the previous season. In 1906 a comparative trial was conducted of two varieties of potatoes grown from sets obtained from English, Scotch, and Irish seed, and these potatoes have been grown for four years without change of seed, in order to ascertain how long such a practice may be profitably followed. A duplicate experiment on similar lines was started in 1907. The varieties were British Queen and Up-to-Date, and the plots were manured each year with ten loads of dung, 4 cwt. basic slag, and $2\frac{1}{2}$ cwt. kainit per acre.

The results so far seem to point to the following conclusions :—(*a*) That Irish and Scotch seed give a better yield than locally grown sets; (*b*) That in the case of imported seed there is a very rapid falling off in the yield after the second year. A change of seed every two years seems necessary. (*c*) That where potatoes are grown without change of seed for more than one year there is much less falling off in the yield in the case of English sets than in the case of either Irish or Scotch. In some cases in these experiments the English sets produced a better crop in the second than in the first year.

Experiments on Potatoes (*Hertford C.C., Leaflet No.* 8.)—This leaflet gives the results of the potato experiments carried out by the Agricultural Department of Cambridge University for the Hertford County Council. In the variety test, the potatoes of the Up-to-Date type gave excellent results as regards yield and quality, but were more subject to disease than most other varieties. Northern Star is stated to be improving, and farmers are advised to include a fair proportion of this

variety in their crops, especially where disease is prevalent. Royal Kidney and King Edward VII., gave a smaller yield than the "Dates," but had the advantage of comparative freedom from disease.

As regards the comparative merits of Scotch and Irish seed, it is considered that Irish seed holds its own against seed from either the North or South of Scotland.

Manurial trials were made, but owing to the high condition of the land the manures had but little effect. In four seasons out of the five in which these potato experiments have been carried out in Hertfordshire, the results of the heavy dressings of dung and artificials have shown a direct financial loss. The extra manures have not increased the crop sufficiently to meet the cost of manuring, and it is observed that such evidence should cause growers to pause before they continue to manure so heavily on land that has been brought up to a high condition of fertility.

Variety and Manurial Trials of Potatoes (*Harper Adams Agric. Coll., Field Expts., Report,* 1909).—A variety test was carried out with a number of early, second early, and maincrop varieties, at the College Farm and at a farm at Orton, both Scotch and Irish seed being used.

A manurial trial at Walton Bank was intended to show which is the best phosphatic manure for potatoes, and superphosphate gave a better return than basic slag. Ground lime was applied to one plot to ascertain its effect in the prevention of potato scab, but no benefit was derived from its application.

Mature and Immature Seed; Effect of Frost (*Harper Adams Agric. Coll., Field Expts., Report,* 1909).—A small trial with immature seed was made, and confirmed experiments made in previous years when immature seed, obtained by lifting part of the ordinary crop early in August, has always produced heavier crops than mature seed.

The effect of frost on greened and ungreened potatoes was tested, and it was found that greened seed was practically unharmed if exposed to 3 or 4 degrees of frost, whereas the ungreened seed was badly frosted, if not killed. When the temperature fell to 24° F. and lower the seed was killed in both cases.

Potato Trials (*Surrey Education Com., Potato Trials, Merton,* 1905; *Farnham,* 1906; *Chessington,* 1907; *Claygate,* 1908).—A number of experiments have been carried out during these four years on varieties, and the comparative value of Scotch and Irish seed, and of mature and immature home-grown seed.

Manuring of Potatoes (*Somerset Agric. Instruction Com., Report on Field Trials of Manures,* 1908).—These trials were carried out at four farms, but the results were somewhat irregular. It is remarked in the report that there is considerable doubt whether Somersetshire growers are in the habit of manuring their potato crop as heavily as they might in order to get the best return. There is a good deal of evidence to show that on land heavily farmed with sheep, a dressing of mineral manures may be expected to give a profitable increase, while on land which is less highly farmed, a dressing of sulphate of ammonia and superphosphate, or sulphate of ammonia and muriate of potash will give equally substantial returns.

Potato Trials (*Dorset Education Committee, Potato Trials and Experiments,* 1909).—These experiments were conducted on four varie-

ties of soils to ascertain (1) the most suitable varieties, and (2) the effect of a moderate dressing of farmyard manure only, compared with a combined dressing of farmyard and artificial manure. As regards varieties, Sir John Llewelyn did best of the first earlies, and British Queen of the second earlies in all four cases. Duchess of Cornwall was the best of the main crops in two out of three cases.

On three soils out of four the addition of a complete dressing of artificial manures to farmyard manure (10 tons per acre) gave a marked increase. The plot where it had little effect was on chalk, very shallow and deficient in organic matter.

Experiments with Potatoes (*Edinburgh and East of Scotland Coll. of Agric., Bulletin* 20).—The relative value of a number of varieties was tested on a farm at Prestonpans, and, taking into account yield, cooking quality, and power of resisting disease, the following varieties gave the best results in 1909:—

Earlies.—For earliest use—Mid-Lothian Early. For later use—Macpherson, Dalmeny Early, Conquest, and Epicure.

Second Earlies.—Dalmeny Acme, Johnston's Diamond, British Queen, King Edward VII., and Dalmeny Gem.

Maincrop Varieties.—Northern Star, and the following of the Up-to-Date type—Up-to-Date, Factor, Dalmeny Hero, and Dalmeny Regent.

Langworthy Type.—Langworthy, Peacemaker, Golden Wonder, and Fascinator were all practically of equal merit. Their outstanding charactertistic is excellence of cooking quality.

The effect of a change of seed was tested and was satisfactory.

With regard to the effect of manures, the following mixture of artificials had been found satisfactory in previous experiments, viz.:—1 cwt. sulphate of ammonia, 4 cwt. superphosphate (30 per cent. sol.), 1 cwt. sulphate of potash (87 per cent. purity). This was again tested at three centres, and it is observed that this may generally be depended upon to yield a profitable return, even when used along with a moderate dressing of dung.

Calcium cyanamide was used as a source of nitrogen in place of the sulphate of ammonia on three plots, but did not prove so satisfactory, while carbonate of magnesia, applied in addition to a complete mixture of artificials, was not profitable.

A comparison was made of large and small seed, but the results were inconclusive.

Manuring of Potatoes (*West of Scotland Agric. Coll., Bulletin* 51).—The experiments which form the subject of this report were carried out in 1907 on seventeen farms, and in 1908 on fourteen farms in the centre and south-west of Scotland. The chief object was to determine the value of certain manures not previously tested, viz., calcium cyanamide, nitrate of lime, potash manure salt, and basic slag. Fourteen plots were laid out at each centre, two of which were unmanured, two received farmyard manure only, and the remainder 10 tons of farmyard manure per acre and various combinations of artificials.

The farmyard manure alone gave a very satisfactory return, though a dressing of 10 tons per acre was proportionately more profitable than one of 20 tons, but generally it appeared that larger and more profitable crops can be grown by small dressings of farmyard manure with the addition of a suitable mixture of artificials than with large dressings

of farmyard manure alone. The most satisfactory mixture in these experiments as a supplement to 10 tons of dung consisted of 3 cwt. superphosphate (30 per cent soluble), basic slag containing citric soluble phosphoric acid equal to that contained in the 3 cwt. superphosphate, 1½ cwt. sulphate of potash (94 per cent. purity), and 1½ cwt. sulphate of ammonia. Giving half the phosphate in the form of basic slag instead of applying the whole as superphosphate, gave a somewhat better return.

With regard to the potash manures, neither the potash manure salt containing 30 per cent. pure potash nor muriate of potash proved such a suitable or profitable potash manure for the potato crop as sulphate of potash of 94 per cent. purity.

Calcium cyanamide, when applied in quantities equivalent to 1 cwt. sulphate of ammonia, showed itself on a number of farms quite as effective as the latter manure, or even more so, but on other farms it proved inferior. If applied in larger quantity it produced no further increase in crop, and showed itself less effective than equal quantities of sulphate of ammonia.

Nitrate of lime showed itself to be a very effective manure, and has also given results in one year equal to those produced by sulphate of ammonia.

Manuring of Potatoes (*Wilts. C.C., Results of Field Manurial Demonstrations,* 1908–9).—Twelve sets of experiments were carried out at six centres in this county, eight plots being laid out in each set. One plot received no artificial manure, one plot received a complete dressing comprising kainit, superphosphate, and sulphate of ammonia; three plots received dressings composed of two of these manures, and three plots dressings of each manure alone. The quantities in each case were as follows:—Kainit, 5¾ cwt.; superphosphate, 4½ cwt.; sulphate of ammonia, 1¾ cwt. In a second series of experiments on the same lines, 1⅜ cwt. of sulphate of potash was substituted for the kainit.

The results at the different centres were somewhat irregular, and the weather was generally unfavourable. In both series the plots which received the complete dressing gave on the whole the best results, followed by the plots which received sulphate of ammonia with potash or superphosphate.

OFFICIAL CIRCULARS AND NOTICES.

Appearance of Large Larch Saw-fly.

The Board of Agriculture and Fisheries desire to give publicity to the fact that the first caterpillars of the Large Larch Saw-fly (*Nematus Erichsoni*, Hart.) were seen this year on the 19th June. They are now probably to be found in all places infested with this pest, and owners of larch plantations should arrange to have their trees examined with a view to the discovery of the pest, which must be notified to the Board in conformity with the Destructive Insects and Pests Order of 1910. A memorandum explaining the means of detecting the caterpillar and of distinguishing it from other pests of the larch can be obtained free on application to the Secretary, Board of Agriculture and Fisheries, 4 Whitehall Place, London, S.W.

The following notice on the Warble Fly has been communicated to the Press by the Department of Agriculture and Technical Instruction for Ireland :—

Prevention of Warble-fly.

The Department's Advisory Committee on Cattle-breeding met last week, Mr. T. W. Russell presiding, and among other questions considered that of the loss caused to cattle owners by warbled hides and warbled beef. The Committee deemed it desirable that the exact position with regard to this pest as indicated by the experiments which the Department have for the last six years been making at their Agricultural Station, Ballyhaise, County Cavan, and elsewhere should be made known to the public, inasmuch as there appears to exist at present considerable confusion in the minds of agriculturists and others as to the best means of eradicating the pest.

Up to a few years ago the belief was held that the fly laid its eggs on the backs of the cattle in summer, and that out of these eggs maggots were hatched which worked their way through the skin, under which they gradually developed into the well-known warbles. The remedy then in vogue was founded upon the belief that the eggs were laid on the backs of the cattle and that the maggots gained entrance by working their way down through the skin. It consisted in smearing the backs of the cattle *in summer* with train oil or some other preparation likely to prevent the fly laying its eggs on the smeared portions of the animal. This remedy was, however, tried repeatedly and most thoroughly by the Department on one half of a batch of cattle at their school farm at Ballyhaise. The backs of the cattle so treated were, however, found to be as full of warbles the following spring as the backs of those which were not treated. These tests show (1) that smearing *in summer*, after the fly is out, to prevent egg laying appears to be useless, and (2) that our knowledge as to how the maggots gain access under the skin of the back of the animals is still obscure.

Repeated experiments to elucidate the manner of egg-laying and the way in which the maggots gain entrance have been made at Ballyhaise, but up to the present there is no definite result, and the difficulty of the problem has been intensified by the fact that Professor Carpenter, of the Royal College of Science, who has been conducting these experiments for the Department, has had no trouble in finding young maggots embedded in the tissues of the gullet of young cattle slaughtered in October.

The details of the various experiments on this subject need not be given here; they are to be found in the publications of the Department.

But, however the maggots gain entrance, there can be no doubt that in the spring they are all to be found under the skin on the backs of cattle, and if they were all destroyed before they escaped there could be no more flies, no more eggs, and therefore no more warbles. The Department have, therefore, for some years directed the attention of farmers to the destruction of the warbles before they escape. This was also strongly advocated at the recent meeting of the Council of Agriculture, and it has been repeatedly referred to in the Department's Reports on the subject. The method suggested in the Department's Reports of squeezing out the warbles has, however, been objected to

by some, and the alternative of smearing the affected parts with a preparation that will kill the warbles has been advocated. Smearing for this purpose should be done mainly in *spring*. It should not be confused with summer smearing, formerly recommended to prevent the fly laying its eggs on the backs of the cattle. The Department have recently had an opportunity of examining at Baronrath, Straffan, County Kildare, the results of smearing to destroy the warble, and they are satisfied that there is no danger of injury to the animal or to the beef by the decay of the dead maggot under the skin. Those, therefore, who still have warbled cattle, and who object to squeezing out the maggots should, though the season is now late, at once have the affected areas treated, taking care that the openings are well covered by the mixture. The smear successfully used by Mr. Kennedy, of Baronrath, Straffan, in the demonstration referred to above consisted of equal parts of Archangel tar and paraffin oil.

Advisory Committee on Agricultural Science.

The President of the Board of Agriculture and Fisheries has appointed a Committee to advise the Board on all scientific questions bearing directly on the improvement of agriculture, and especially as to the methods to be adopted (*a*) for promoting agricultural research in universities and other scientific schools; (*b*) for aiding scientific workers engaged in the study of agricultural problems; and (*c*) for ensuring that new scientific discoveries are utilised for the benefit of agriculturists.

The Committee will consist of his Grace the Duke of Devonshire, P.C., the Right Hon. Lord Reay, G.C.S.I., G.C.I.E., Sir Edward Thorpe, C.B., F.R.S., Mr. David Davies, M.P., Dr. J. J. Dobbie, F.R.S. (Principal of the Government Laboratories), Professor J. B. Farmer, F.R.S., Dr. S. F. Harmer, F.R.S. (Keeper of Zoology at the Natural History Museum), Dr. R. Stewart MacDougall, M.A. (Technical Adviser in Zoology to the Board of Agriculture and Fisheries), Mr. T. H. Middleton, M.A., M.Sc. (one of the Assistant Secretaries to the Board of Agriculture and Fisheries), Mr. Spencer U. Pickering, F.R.S., Lieut.-Col. David Prain, C.I.E., F.R.S. (Director of the Royal Botanic Gardens, Kew), Mr. H. S. Staveley-Hill, M.P., Mr. Stewart Stockman, M.R.C.V.S. (Chief Veterinary Officer of the Board of Agriculture and Fisheries), Dr. J. J. H. Teall, F.R.S. (Director of the Geological Survey and Museum), Dr. David Wilson, M.A.

Mr. Middleton will act as Chairman of the Committee, and one of the officers of the Intelligence Division of the Board will act as Secretary.

Rural Education Conference.

The Rural Education Conference, which has been constituted by the Presidents of the Board of Agriculture and Fisheries and the Board of Education, for the discussion of all questions connected with education in rural districts and for the periodical exchange of views between representative agriculturists and the two Departments will be composed as follows:—

Lord Moreton (Royal Agricultural Society of England); Lord

Barnard (Central Land Association); The Right Hon. Lord Belper; the Right Hon. Lord Reay, G.C.S.I., G.C.I.E.; the Right Hon. Arthur H. Dyke Acland; the Right Hon. Henry Hobhouse (County Councils Association); Sir Francis A. Channing, Bart., M.P.; Sir Albert K. Rollit (Royal Horticultural Society); Major P. G. Craigie, C.B.; Mr. Graham Balfour (County Councils Association); Mr. Chas. Bathurst, M.P. (Central Chamber of Agriculture); Mr. G. A. Bellwood (National Farmers' Union); Mr. J. F. Blackshaw (Agricultural Education Association); Mr. W. Fitzherbert Brockholes (Lancashire Farmers' Association); Mr. G. G. Butler (University of Durham); Mr. A. W. Chapman (County Councils Association); Mr. F. J. Chittenden (Royal Horticultural Society); Mr. S. H. Cowper-Coles (Land Agents' Society); Mr David Davies, M.P. (Welsh National Agricultural Society); Major J. W. Dent (University of Leeds); Mr. H. J. Elwes, F.R.S. (Royal English Arboricultural Society); Professor W. R. Fisher (Royal English Arboricultural Society); Mr. P. Hedworth Foulkes (Agricultural Education Association); Mr. W. J. Grant (British Dairy Farmers' Association); Mr. A. D. Hall, F.R.S. (Agricultural Education Association); Mr. A. W. Haviland (Central Land Association); Professor C. Bryner Jones (University College of Wales, Aberystwyth); Mr. T. Latham (Farmers' Club); Mr. J. L. Luddington (Royal Agricultural Society of England); Mr. Howard Martin (Surveyors' Institution); Mr. Ernest Mathews (Royal Agricultural Society of England); Rev. Rollo Meyer (Agricultural Organisation Society); Mr. Wm. Parlour (North-Eastern Agricultural Federation); Mr. C. N. P. Phipps (Bath and West and Southern Counties Society); Mr. J. H. Sabin (Surveyors' Institution); Mr. A. F. Somerville (Bath and West and Southern Counties Society); Professor Wm. Somerville, M.A., D.Sc. (University of Oxford); Mr. A. E. Bromehead Soulby (Yorkshire Union of Agricultural Clubs and Chambers of Agriculture); Mr. Chris. Turnor (Central Chamber of Agriculture); Mr. F. Verney, M.P.; Professor T. Winter, M.A. (University College of North Wales, Bangor); Professor T. B. Wood, M.A. (University of Cambridge).

The Right Hon. Henry Hobhouse will act as Chairman of the Conference, and Mr. E. G. Howarth, of the Board of Education, and Mr. H. L. French, of the Board of Agriculture and Fisheries, will act as Joint Secretaries.

Departmental Committee on Employment in the Ordnance Survey.

The President of the Board of Agriculture and Fisheries has appointed a Departmental Committee to inquire into the pay and classification of the Civil Assistants, Temporary Civil Assistants, and Labourers employed on the Ordnance Survey, and to report whether, having regard to the conditions of their employment and to the rates current in analogous occupations, their remuneration is adequate.

The Committee will be constituted as follows:—The Right Hon. Sir Walter Foster (Chairman), G. L. Barstow, Esq. (a Principal Clerk in the Treasury), Colonel J. W. Greig, M.P., Geo. D. Kelley, Esq., and F. Newman Rogers, Esq.

Major W. C. Hedley, R.E., of the Ordnance Survey, will act as Secretary.

Departmental Committee on Fiars Prices.

The Secretary for Scotland and the President of the Board of Agriculture and Fisheries have appointed a Departmental Committee to inquire into the present system of striking Fiars Prices in Scotland and to report whether the procedure of Fiars Courts can be amended so as to ensure that the annual value of corn and other produce shall be ascertained on a more uniform basis and with greater accuracy, and, if so, what are the best means of attaining that object. The Committee will be constituted as follows:—Mr. Donald Crawford, K.C., Sheriff of Aberdeen, Kincardine, and Banff (chairman); Mr. Christopher N. Johnston, K.C., Sheriff of Perthshire; Mr. Andrew Aikman, Mr. James I. Davidson, Major G. McMicking, C.M.G., Mr. R. H. Rew, and Mr. H. M. Conacher. Mr. William Dunbar, Advocate, of 67 Great King Street, Edinburgh, will act as secretary to the Committee.

Fream Memorial Prize.

The Board of Agriculture and Fisheries have awarded a Fream Memorial Prize of the value of £7 1s. 9*d*. to Mr. James Bernard Garnett, Brampton-en-le-Morthen, Rotherham, a student at Leeds University, who obtained the highest marks at the examination held in April last for the National Diploma in Agriculture.

Regulations as to Applications for Advances from the Development Fund.

The Treasury have made the following Regulations, dated June 13th, 1910, under Section 1 (2) of Part I. of the Development and Road Improvement Funds Act, 1909 (9 Edw. 7, c. 47), as to Applications for Advances:—

In pursuance of the powers conferred on them by section 1 (2) of the Development and Road Improvement Funds Act, 1909, my Lords make the following regulations:—

1. All application for Advances under Part I. of the Act shall be made to the Treasury in writing, and addressed to the Secretary to the Treasury, Whitehall, S.W.

2. Applications by a Government Department shall be made by letter in such form as may seem most convenient to the Department making application.

3. Other applications shall be supported by Resolution of the public authority, or of the governing body of the University, College, School, or Institution, or of the Association of persons or Company, and a copy of the Resolution, certified by the Chairman, Clerk, or Secretary, shall be annexed to the application.

4. Every application shall state whether the advance sought is by way of grant or by way of loan, or partly in one way and partly in the other; the amount of the advance desired in either category, and the purpose (see Note) to which the advance is to be applied.

With the application shall be forwarded a brief abstract of the scheme proposed, in duplicate, or, where possible, printed copies shall be supplied.

5. Applications, other than applications by a Government Department or by a public authority, shall contain a brief statement of the constitu-

tion of the University, College, School, or Institution, or of the Association of persons or Company not trading for profit, making the application, respectively, and copies of the audited accounts for the last financial year of the body making application shall be forwarded at the same time.

6. The applicants shall state in every case what funds from sources other than the Development Fund are available for the purpose in view, and from what source they are derived.

Note.—The purposes stated in the Act are—

(*a*) Aiding and developing agriculture and rural industries by promoting scientific research, instruction, and experiments in the science, methods and practice of agriculture (including the provision of farm-institutes), the organisation of co-operation, instruction in marketing produce, and the extension of the provision of small holdings; and by the adoption of any other means which appear calculated to develop agriculture and rural industries;

(*b*) Forestry (including [1] the conducting of inquiries, experiments, and research for the purpose of promoting forestry and the teaching of methods of afforestation; [2] the purchase and planting of land found after inquiry to be suitable for afforestation);

(*c*) The reclamation and drainage of land;

(*d*) The general improvement of rural transport (including the making of light railways, but not including the construction or improvement of roads);

(*e*) The construction and improvement of harbours;

(*f*) The construction and improvement of inland navigations;

(*g*) The development and improvement of fisheries; and for any other purpose calculated to promote the economic development of the United Kingdom.

For the purposes of this part of this Act the expression "agriculture and rural industries" includes agriculture, horticulture, dairying, the breeding of horses, cattle, and other live stock and poultry, the cultivation and preparation of flax, the cultivation and manufacture of tobacco, and any industries immediately connected with and subservient to any of the said matters (sec. 6).

Return as to Small Holdings.

A Return [H.C. 145] has been made in pursuance of an Order of the House of Commons giving certain particulars as to Small Holdings up to 31st December, 1909. The Return is accompanied by the following memorandum :—

This Return shows that the number of applications for small holdings under the Small Holdings and Allotments Act, 1908, which had been received by county councils in England and Wales to the 31st December, 1909, was 26,682, including applications from associations, which have not in all cases been shown separately. The number of applicants approved was 15,359, exclusive of Gloucester, Anglesey, and Brecon, for which figures are not given, but where it is stated that practically all the 1,117 applicants in those counties were approved. This figure, however, does not represent the number of applicants for which small holdings either have been

or remain to be provided. Some applicants have withdrawn their applications upon finding that the particular piece of land desired could not be obtained, or that the rent was more than they were prepared to pay. A considerable number have been satisfied by private arrangement. On the other hand, further applications have been made since the 31st December last, and will doubtless continue to be received.

Four county councils, viz., those of London, Carnarvon, Merioneth, and the Isles of Scilly, had not acquired any land under the Act. The remaining councils had acquired a total area of 58,787 acres.

Ten counties, nine in England and one in Wales, had acquired land compulsorily, the area so acquired being 2,349 acres.

The average price per acre of the land purchased by agreement varied from £51 14*s.* 6*d.* in the parts of Holland (Lincolnshire) to £16 18*s.* in Monmouth. For the land purchased compulsorily the price varied from £51 5*s.* 1*d.* in Gloucester to £23 in Devon.

The average annual rent per acre of the land leased by agreement varied from £2 15*s.* in Middlesex to 13*s.* 2*d.* in Rutland. For the land hired compulsorily the average annual rent varied from £2 16*s.* per acre in Cumberland to £1 0*s.* 7*d.* per acre in Monmouth.

Twenty-seven small holders abandoned their holdings subsequent to their acquisition.

Five hundred and twenty-two applicants applied to purchase their holdings. The number of such applications in England was 407, and in Wales, 115. In 19 of the 63 counties no applications for purchase were received.

Circular as to the Small Holdings and Allotments Act, 1908.

The Board have issued the following Circular, dated June 12th, 1910, to the Clerks of County Councils and the Town Clerks of County Boroughs as to certain matters connected with the Small Holdings Act, 1908:—

SIR,

I am directed by the Board of Agriculture and Fisheries to inform you that, with the concurrence of the Lord Chancellor, they have made Rules fixing a scale of costs applicable to arbitrations under Part I. of the First Schedule to the Small Holdings and Allotments Act, 1908. The Rules, of which two copies are enclosed herewith, apply only where the arbitrator's appointment is dated on or after the 10th March last.

Costs of Raising Loans.—I am also to acquaint you that the Public Works Loan Commissioners have recently decided that they are unable to advance the costs of raising loans for the purchase of land for the purposes of small holdings, and that in these circumstances the Board have obtained the authority of the Treasury to repay the costs of raising such loans, including any incidental expenses, out of the Small Holdings Account, as part of the expenses incurred in relation to the acquisition of land. This arrangement will not be applicable where the costs have already been raised. Claims for repayment should be made in accordance with the instructions contained in the Board's Circular Letter of the 22nd September last (A 184/C).

The particulars of each transaction should be set out in the claim and it should be specifically stated whether or not the amount claimed

has already been included in any loan. Where the amount of the loan includes provision for other purposes besides the purchase of land a proportion only of the costs should be included in the claim.

The decision of the Commissioners does not apply to the costs of raising loans sanctioned for any other purpose than the purchase of land, and such costs can be included in the loan obtained from the Commissioners.

Registration of Title.—The Board are of opinion that registration with a possessory title is sufficient for the purposes of the Act, and repayment of expenses under section 21 of the Act will be made on this basis.

The Registrar will be prepared to accept applications for registration with a possessory title consisting merely of a request to register the land with a possessory title accompanied by the conveyance to the Council and a certified copy thereof on foolscap, on the understanding that any further evidence or information will be supplied which may be required.

The application may be sent by post and be in the following form or to the like effect:—

"To the Registrar,
"Land Registry,
"Lincoln's Inn Fields, W.C.

"On behalf of the Council I apply for "the registration of the Council as proprietor with possessory title of "the freehold property in the parish of in the "county of described in the accompanying "conveyance which land has been [compulsorily] purchased for small "holdings by the Council under the Small Holdings and Allotments Act, "1908. I enclose cheque for £ in respect of the fee for "registration. Should any question arise in identifying the lands you "are requested to communicate with [*Here state name and address of* "*County Surveyor or Land Agent*]."

The Board will be prepared to repay the following legal charges in respect of business connected with the registration of the title of a County Council, in addition to the cost of the preparation of a copy of the map or plan on the conveyance, viz.:—

	s.	*d.*
Letter of application for registration	6	8
Certified Copy of Conveyance (6*d.* per folio)	—	
Perusing and approving draft entries	6	8
Acknowledging receipt of Certificate and deed	3	4

Recovery of Income Tax.—The Board have received inquiries from County Councils as to claims which have been made for the payment of Income Tax on the rents of properties acquired for small holdings, and they have been in communication with the Commissioners of Inland Revenue on the subject. The Board are informed that the Commissioners are prepared to grant relief from Income Tax in respect of interest paid by County Councils to the Public Works Loan Commissioners, but as the method by which such relief may most conveniently be granted differs according to the circumstances of the particular case,

the Commissioners ask that County Councils will communicate with them direct on the subject.

Enfranchisement of Copyholds.—The Board desire me to call your attention to the fact that Sections 95 to 98 (*Copyhold Lands*) of the Lands Clauses Consolidation Act, 1845, are incorporated in the Small Holdings and Allotments Act, 1908, for the purpose of the purchase of land by agreement as well as by compulsion, and the procedure of those sections should be followed in all cases of the purchase of copyhold land, except where the purchaser is willing, at the expense of the Council, to enfranchise the land before its conveyance, and the Council think that course will save expense.

The Board take this opportunity to point out that in letting land for small holdings Councils are not restricted to letting on annual tenancy. The Board are aware that in some cases Councils have granted their tenants leases for terms of years and they would suggest that your Council should consider whether this course could not, with advantage, be adopted more frequently. In the case of suitable applicants who express a wish to take land on lease the Board think that no obstacle should be put in the way of their doing so. Cases may occur in which Councils, in order to satisfy a particular applicant, acquire land which they might find some difficulty in re-letting in the event of the tenant giving it up. In such cases it might be desirable in the interests of the Council to arrange with their applicant to take the land on lease.

I am, &c.,
T. H. ELLIOTT,
Secretary.

American Gooseberry Mildew (Chapel Fields Allotments) Order.

The Board of Agriculture and Fisheries have made an Order, dated 9th June, 1910, entitled the American Gooseberry Mildew (Chapel Fields Allotments) Order of 1910, prescribing precautions to be taken in picking gooseberries on the allotments known as the Chapel Fields Allotments, Somersham, Huntingdon.

MISCELLANEOUS NOTES.

Demand for Agricultural Machinery, &c., Abroad.

Agricultural Machinery in the Bordeaux District.—H.M. Consul at Bordeaux (Mr. R. D. G. Macdonald), in his Report for 1909 (*F.O. Reports, Annual Series, No.* 4,456), states that the total weight of agricultural machinery imported into the Consular district in 1909 was 8,558 tons, an increase as compared with 1908 of 1,915 tons. Imports from the United Kingdom amounted to 884 tons, against 1,041 tons in 1908. The year was an average one as regards the sale generally of agricultural implements, the increase in imports on those in 1908 being due to the fact that very large stocks remained over in that year from 1907, and had to be disposed of before fresh purchases could be made. The revision of the French import tariff also contributed to some extent, by inducing importers to increase their stocks from abroad in anticipation of higher duties.

Agricultural Machinery, Adrianople, Turkey.—H.M. Consul at Adrianople (Major L. L. R. Samson), in his Report for 1909 (*F.O. Reports, Annual Series, No.* 4463), states that the more important agricultural machines, such as threshing machines, which are supplied by British firms, have been practically unsaleable owing to the scarcity of money amongst agriculturists. Ploughs of German make can now be purchased as cheaply as £1 apiece, and sales of these have amounted to about £1,500.

Opening for Machinery in the Transvaal.—H.M. Trade Commissioner for South Africa (Mr. R. Sothern Holland) reports that Dr. W. Macdonald, who was deputed by the Transvaal Government to attend the third annual meeting of the Trans-Missouri Dry Farming Congress, held in Wyoming, United States of America, has, as a result of his visit, recommended that a "dry farming" division should be at once established in the Transvaal Department of Agriculture, and that the Government should acquire a steam or gasoline direct traction engine for the use of this division.

H.M. Trade Commissioner suggests that British manufacturers interested should put themselves in communication with Dr. Macdonald, giving evidence of their ability to supply engines and tackle equal in efficiency and economy to the American machinery that the latter gentleman had an opportunity of inspecting during his tour in America. Mr. Holland points out that, in the event of the Transvaal Government establishing an experimental station in accordance with Dr. Macdonald's suggestion, the plant employed there with success is likely to be regarded by Transvaal farmers adopting the method of dry farming as suitable for their own use.

A copy of the report by Dr. Macdonald to his Government, containing descriptions of American agricultural machinery inspected by him, may be seen by British firms at the Commercial Intelligence Branch of the Board of Trade, 73 Basinghall Street, London, E.C.—(*Board of Trade Journal,* June 9th, 1910.)

Agency for Sale of Fertilisers, Machinery, and Live Stock in Spain,—The British Acting Consul at Bilbao (Mr. J. Innes) reports that a firm at that place desire to obtain the agency of important British manufacturers and exporters of artificial manures, preferably those not already represented in Spain. The same firm also wish to represent British makers of agricultural and dairy machinery and accessories, and breeders of cattle, sheep, and poultry.

Communications regarding the above should be addressed to the British Consulate, Bilbao.—(*Board of Trade Journal,* June 9th, 1910.)

Agricultural Machinery in the North of Spain.—H.M. Consul at Corunna (Mr. F. Medhurst), in his Report for 1909 (*F.O. Reports, Annual Series, No.* 4461), states that the demand for agricultural machinery is very small, but latterly that for small threshing machinery has increased somewhat. Much of the threshing is still performed with flails, but Germany and France supply cheap hand-threshing machines. The model most in demand appears to be a German make. The machines weigh only 470 kilogs., and are retailed in Corunna at £19 10*s.* (without horse gear). Another machine of the same type, weighing 245 kilogs., to be worked by hand only, is sold at £7 15*s.*

The Report by the British Vice-Consul at Gijon, Province of

Asturias, Spain, states that improvement in methods of agriculture is very slow; the use of modern implements, however, is increasing, thanks to the energy of several merchants who spare no effort to push the sale of cheap American and Belgian ploughs and other implements. A large trade is being done in scythes, sickles, and hoes, the two former mostly imported from Austria. The scythes are of a very showy description, being highly polished and bearing the figure of a female reaper stamped on them in different colours; this makes them very popular among the peasant farmers.

Exhibitions and Congresses Abroad.

Show of Machinery and Implements at Accra.—An Agricultural Show will be held at Accra (Gold Coast) on 25th and 26th November next, and the Commercial Intelligence Branch of the Board of Trade are informed that British exhibits of agricultural implements, &c., are especially invited for the show. Prizes are to be awarded for the best specimens of machinery for treating rubber and cocoa, and for nut-cracking, and also for the best type of hand or horse cart suitable for the Gold Coast. All agricultural labour in the colony is done by hand, and exhibits of implements, such as hoes, pick-axes, axes, and tapping knives for rubber will be welcomed. Exhibits will be carried *freight free* to and from the show by the Elder Dempster Line, provided they are plainly marked as for the Agricultural Show.

Exhibits for the International Exhibition of Horticultural Products at Paris.—The French *Journal Officiel* for the 31st May contains a French Presidential Decree, dated the 30th May, which constitutes as a Customs warehouse the grounds of the International Exhibition of Horticultural Products, to be held at the Cour-la-Reine, Paris, from the 4th to the 13th November next. Articles intended for exhibition there may be forwarded through to their destination, under ordinary or international transit regulations, without Customs examination at the frontier.

Exhibition at Rostov-on-Don.—H.M. Consul-General at Odessa (Mr. C. S. Smith) reports that an Agricultural and Industrial Exhibition is to be held at Rostov-on-Don in September and October next. The Industrial section, including dairy appliances and agricultural machinery, as well as manufacturing industries proper, is to be open from 10th/23rd September to 26th September/9th October. Applications for space will be received up to 6th/19th September.

Copies of the Exhibition programme (in Russian) may be obtained by British firms on application to the Commercial Intelligence Branch of the Board of Trade, 73 Basinghall Street, London, E.C.—(*Board of Trade Journal*, June 23rd, 1910.)

Forestry Congress at Brussels.—The Board are informed that the Congress of the *Association Internationale des Stations de Recherches Forestières* (a preliminary report of which appeared in this *Journal* for November, 1909), will meet daily from the 10th September until the 19th September, 1910. Visits have been arranged for the members of the Congress to various woods and forests and experimental nurseries, and inspection will be made of experiments in progress.

Agricultural Show at Lagos.—The Board have received a list of the awards to be made in connection with the various sections of this exhibition, which is to be held at Lagos from 8th to 10th December next. This list may be consulted on application at the Office of the Board, 8 Whitehall Place, S.W. Exhibits of machinery will be carried freight free from Liverpool by the Elder Dempster Line. The latest date for despatching exhibits from Europe is October 26th, and intending exhibitors should, in September, notify the manager of the show at Lagos of their intention to participate, giving full information concerning the implements or machinery to be shown, and of the ordinary trade selling prices. The Manager should also be advised if the exhibits are for sale, and, if so, the lowest price which may be accepted.

Turin International Exhibition.—The Royal Commission for the Brussels, Rome, and Turin Exhibitions have issued a Memorandum of information relating to the Turin International Exhibition, 1911. An Agriculture, Horticulture, and Food Products Committee has been formed, of which Sir Thomas Elliott, K.C.B., is Chairman, for the purpose of assisting the Royal Commission. Copies of the Memorandum and other information respecting the Exhibition can be obtained from the Director of the Exhibitions Branch, Board of Trade, Queen Anne's Chambers, Broadway, Westminster, S.W.

The Exhibition will be opened at Turin in April, 1911, and will remain open for about seven months.

The General Classification of the Exhibition comprises the following subjects bearing on agriculture and its allied industries:—*Group* 1, Class 41.— Agricultural Education; Class 5.—Work of the State, County Councils, Corporations, Societies, and other public and private bodies and Associations on behalf of Technical, Commercial and Agricultural Education. *Group* 15, Class 79.—Economics of Forestry; Class 80.—Forest Management; Class 83.—Pisciculture. *Group* 16, Class 85.—Farm Buildings; Class 86.—Meteorology, Agricultural Geology, and Study of Soils; Class 87.—Agricultural Machinery; Class 88.—Methods and Systems of Manuring; Class 89.—The Cultivation of the Vine; Class 90.—Products of Farming on a Large Scale; Class 91.—Cultivation of Fruits, Vegetables, and Flowers; Class 92.—Gardening Implements and Tools; Class 93.—Teaching and Appliances for Teaching; Class 94.—Plant Pathology; Class 95.—Rearing of the Silk-worm; Class 96.—Bee-keeping; Class 97.—Rural Economy and Statistics. *Group* 17, Class 98.—Farinaceous Products and their Derivatives; Class 99.—Baking; Class 101.—Meat, Fish, Vegetables, and Fruits; Class 102.—Fatty Substances, Milk Products, Oil, Eggs, &c.; Class 105.—Beer and other Beverages. *Group* 18, Class 122.—Chemical Manures, *Group* 24, Class 161.—Co-operation and Thrift.

International Congress on the Breeding and Feeding of Live Stock.—An International Congress on the above subject will be held at Brussels from the 22nd to the 25th September next. The subjects proposed for discussion will include both scientific and practical questions connected with the breeding, improvement, rearing, and feeding of racehorses, cart and carriage horses, dairy cows, cattle, sheep, and pigs. Application for membership should be addressed to the Secretariat Général, 83 Rue Royale, Brussels.

Prize for Experimental Work on the Nutritive Value of Milk.—The

International Dairy Federation have established a prize of 500 francs to be awarded at each meeting of the International Dairy Congress for the best work on a subject to be selected.

The subject for the first competition is:—The determination, by means of new experiments made at any rate partly on man, of the comparative nutritive value of raw and cooked milk (*i.e.*, pasteurised, sterilised, and dried). In the event of an advantage being shown in favour of raw milk, to determine the part played by the enzymes of milk in nutrition.

Essays may be in French, German, or English, and should be submitted before 1st April next, addressed to the Secrétariat général de la Fédération International de Laiterie, 23 rue David Desvachez, Bruxelles-Uccle, Belgium, from whom further information may be obtained.

Exhibition of Animals and Machinery at St. Petersburg.—An exhibition is to be held at St. Petersburg by the Northern Agricultural Society from August 28th to September 4th, 1910, under the name of the "1st Russian Exhibition of Horned Animals." The Executive Committee hope that foreign manufacturers of machinery for the preparation of food for animals will participate in the exhibition.

Notes on Agriculture Abroad.

Agriculture in the United States.—Information as to local conditions of farming and the production of crops in the United States is given in three Foreign Office Reports recently issued, viz., Boston (*Annual Series,* No. 4473); St. Louis (No. 4462); and San Francisco (No. 4459). The following notes are taken from the Report on the Consular District of San Francisco:—

Hop Growing in California.—In contrast to the exceedingly discouraging conditions faced by the hop growers last year, 1909 has shown a remarkable revival of interest in that industry, brought about by the high prices received for hops this season compared with last. While there was a lighter crop of hops on the Pacific coast than in 1908, the difference in production was not sufficient to account for the doubling and trebling of prices received for the product this year. The fact that the European crop was largely a failure forced dealers to come to the United States for supplies, and growers have accordingly reaped a good profit, a considerable amount having been sold at 20 c. (10*d.*) per lb. and upwards.

Hop picking by machinery.—The hop-picking machine, to which reference was made in this *Journal,* Vol. XVI., May, 1909, p. 145, and January, 1910, p. 849, is now alleged to be a success. Last year before the picking had progressed a similar announcement was made, but was afterwards contradicted. The defective features of the machine have been improved and a demonstration was given before many leading hop growers in September, 1909.

The hop vines were cut off near the ground and fed into the machine and came out stripped of hops and leaves. At one side of the machine the hops were deposited and at the other side the leaves and bits of vines were expelled. Experts and persons who were sceptical on the subject now believe that hop picking by machinery is practicable.

Efforts to Exterminate Fruit Pests.—In an effort to exterminate

what is known as the cotton scale, a consignment of ladybirds has been imported from Australia and let loose in two or three large orchards in the vicinity of Lodi, California, as an experiment. Up to date they have proved a great success and the pest in these particular orchards is disappearing rapidly.

The Horticultural Commission has charge of the experiment, and the members assert that it is proving far more successful than they had anticipated. It is not considered necessary to spray the trees after these ladybirds get through their work.

Report on Crop Prospects on July 1st.

The crop estimators of the Board, in reporting on the state of the crops and the agricultural conditions on July 1st, generally comment on the beneficial influence of the warm and sunny weather of the first three weeks of June upon the growth of the corn, potato, and grass crops. The rains which fell in the last week of June were also favourable to the growth of the root crops in England, and in Scotland the rain was welcomed for nearly all crops. The continuance of the wet weather and the frequent heavy storms have, however, seriously interfered with the ingathering of the hay crop.

The wet and cold autumn was unfavourable to the cultivation of the land, and much of the wheat-sowing had to be deferred. The area under wheat is generally reported to be rather less than in 1909. The appearance and prospects of the wheat crop materially improved in June, and on the whole a yield slightly in excess of the average is at present anticipated.

A slightly over-average crop is also expected in the case of barley, although reports on the crop are less favourable in the eastern division of England and the north-eastern division of Scotland. The area under barley appears to be somewhat less than last year.

The oat crop is reported to have suffered from the ungenial spring and dry weather of June in many counties of England, but prospects are good in the west midland and south-western divisions of England and in Wales. In Scotland the dry June checked the growth of the crop. The acreage under oats this year has probably increased, and an average yield is anticipated for Great Britain as a whole.

The season is reported to have favoured beans and peas, which are expected to yield somewhat above average.

Potatoes are a very promising crop throughout the country, and the acreage planted is reported as about the same as in the previous year.

The hay crop from clovers and "seeds" and also from meadows is generally reported as abundant in England and Wales, though less satisfactory in Scotland.

Orchards are reported to have been much damaged by late frosts in all the principal districts, and all tree fruit is very deficient. Strawberries were a large crop except in Scotland, and raspberries are likely to be a fair crop, but currants and gooseberries are, on the whole, under average.

Hops are favourably reported on from all districts; the bine is strong and healthy, and not seriously affected by vermin.

The supply of labour is generally sufficient for all requirements, although a scarcity, especially of skilled labourers, is reported from some districts. Several estimators refer to the scarcity of boys and young labourers, and the increasing use of labour-saving machinery is also mentioned.

Cattle and sheep are reported to be doing well in all parts of the country, although in some districts sheep and lambs are less favourably reported on than cattle. Keep is generally abundant.

Summarising the reports, and representing an average crop by 100, the appearance of the crops on July 1st indicates yields for Great Britain which may be represented by the following percentages:—Wheat, 101; barley, 101; oats, 100; beans, 101; peas, 101; potatoes, 104; mangold, 102; "seeds" hay, 106; meadow hay, 105; hops, 107.

Notes on the Weather in June.

In the *first* week, ending on June 4th, the conditions were generally cloudy or overcast, with frequent rain, especially in the western districts. Warmth was "moderate" in England, except in the north-east and east, where it was "unusual." Sunshine was "scanty" or "moderate" everywhere (England north-west, "very scanty"), and rainfall was generally "moderate."

In the *second* week the weather was generally very fair to fine in Scotland, and the north-east and east of England, but elsewhere the conditions, although occasionally fine and bright, were mostly dull and close. Warmth was "unusual" or "very unusual" all over the country, and sunshine generally "abundant" in Scotland, and "scanty" in England. Rainfall varied greatly in different localities.

In the *third* week the weather was at first rather unsettled, with slight falls of rain over a considerable part of the country, and thunderstorms in some parts of southern and north-western England. Afterwards the condition became very dry and generally bright. On the whole, though warmth was generally "moderate," sunshine exceeded the normal, and very little rain was experienced.

In the *fourth* week the fine weather at first continued, but in the course of a day or two unsettled conditions set in all over the country, and thunderstorms were experienced every day in many parts, accompanied by heavy local rains.

These unsettled conditions continued throughout the *fifth* week, showers and thunderstorms being frequent. Warmth and sunshine were below the normal everywhere, and rainfall exceeded the mean, the excess in England being large

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Notes on Crop Prospects Abroad.

The following information has been published by the International Institute of Agriculture, Rome, in the *Bulletin of Agricultural Statistics* for June (No. 6):—

The (average) conditions of the crops on June 1st is given as follows, and represents the information received up to June 16th:—

WINTER CEREALS: CONDITION OF CROPS (100 = average).

	Wheat.	Rye.	Barley.	Oats.
Germany [1]	2·3 *	2·6 *	—	—
Austria [1]	1·9 *	2·5 *	2·2 *	2·3 *
Belgium	90 †	95 †	95 †	—
Bulgaria	120	120	120	110
Denmark	101	98	95 †	—
France [2]	69·7 ‡	71·3 ‡	73·3 ‡	69·5 ‡
Hungary	120	112	130 ‡	—
Luxemburg	98	87	106	—
Netherlands	110 ††	105 ††	110 ††	—
Roumania	105 ‡	105 ‡	103 ‡	—
Sweden	107—109	102—105	—	—
Switzerland	103	101	102	—
Canada [3]	87·65	—	—	—
United States	97·7	100·8	—	—
Japan	98 †	—	98 †	146 †
Tunis	105	—	100	120

SPRING CEREALS: CONDITION OF CROPS (100 = average).

	Wheat.	Rye.	Barley.	Oats.
Denmark	—	—	102	102
Germany [1]	2·5 *	2·4 *	2·4 *	2·5 *
France [2]	72·1 ‡	—	73·8 ‡	74·6 ‡
Hungary	—	—	108	95
Luxemburg	99	96	100	97
Switzerland	100	100	102·5	102
Sweden	—	—	106	103—108
Canada [3]	91·49	—	92·94	93·95
United States	99·8	—	—	—

* May 15th. † April 1st. ‡ May 1st. †† April 12th.

[1] Scale: 1 = very good; 2 = good; 3 = average; 4 = poor; 5 = very poor.
[2] Scale: 100 = very good; 80 = good; 60 = fairly good.
[3] Percentages of a "standard" condition. The condition of the crop at the same time last year was 82·15.

The following supplementary information is also given:—

Austria (*May* 15*th*).—Although the temperature at the beginning of May was very low, good rains have fallen, and wheat is well developed. The general condition of wheat is better than for last month. Rye, however, has suffered from the abnormal weather conditions.

Hungary (*May* 28*th*).—In the greater part of the country, winter crops are well developed. As regards harvest prospects for winter wheat, very diverse opinions prevail; however, in general, the reports state that a good average harvest may be expected.

Denmark.—The weather is good, but in Jutland the winter crops are thin and low.

Switzerland.—Winter cereals are a little backward on account of a cold spring, but the outlook is good. Some damage from storms has been reported. Here and there rust has been announced.

The condition of spring crops is normal. Damage from hail and rust is reported in certain districts.

Canada.—During the greater part of the month the weather has been very dry in the "prairie" provinces. Considerable precipitation since the 14th has been very beneficial. Harvest prospects are encouraging; but the cold weather during June has delayed the progress of the crops.

Argentina.—The Government of Argentina has telegraphed that unfavourable weather conditions prevailed during the preparation of the ground, thus causing a delay in the season as compared with last year.

New Zealand.—During the preparation of the ground, meteorological conditions were favourable, and during sowing, excellent; 70 per cent. of the work of sowing was completed by June 1st. The season is, in general, the same as last year.

Germany.—According to the Report of the Imperial Statistical Bureau, referring to the middle of June, the condition of the crops was as follows:—Winter wheat, 2·2; spring wheat, 2·5; winter rye, 2·4; spring rye, 2·5; barley, 2·5; oats, 2·6; potatoes, 2·5 (1 = very good; 2 = good; 3 = medium (average); 4 = small). The month was characterised by unusually high temperatures, and in many districts complaints were made of drought. On the other hand, in many parts great damage has been done by rain and hail.

Winter cereals withstood the drought well, and, on the whole, the prospects of harvest are still more favourable than in the previous month. Reports vary with regard to spring cereals. The growth has been good where rain has fallen, but in the districts where drought has prevailed, the crop is backward, especially in the case of oats.

The condition of the potato crop varies, and is defective in some cases, although on the whole the reports are satisfactory.

Austria.—The *Statistische Nachrichten* of the 28th June gives the conditions of the crops as follows:—Wheat, 1·9; rye, 2·2; barley, 2·6; oats, 2·8; potatoes, 2·3 (1 = very good; 2 = above average; 3 = average; 4 = under average). The condition of wheat has not varied from that of the previous month, although in many places great damage was done by hail, and in others rust is reported. The rye has developed well, although this crop has also suffered from the stormy weather. Barley and oats are backward, especially in the higher lands. Potatoes are generally healthy, and in the south are already in blossom; in the Carpathian districts, however, the crop has suffered from drought.

According to the Report for 31st May, the young hop plants were doing very well and had a fresh, healthy appearance. In Südsteiermark and in the hop districts of Bohemia the plants were being trained on the wires. As regards fruit, the *Statistiche Nachrichten* for June 14th states that the cold rainy weather experienced in the first half of May had an unfavourable influence on the fruit crop. The condition of the apple-trees, however, points to a good crop. The crop of cherries in South Tyrol, Dalmatia, and the coast lands will probably be inferior to that of previous years.

Hungary.—According to the Report issued by the Hungarian Ministry of Agriculture in the middle of June, the acreage and yield of the principal crops are estimated as follows, as compared with the acreage and yield at a similar period last year:—

	1910.		1909.	
	Acres.	Cwt.	Acres.	Cwt.
Wheat ...	8,716,000	107,306,000	8,139,000	60,707,000
Rye	2,789,000	32,242,000	2,642,000	23,530,000
Barley ...	2,927,000	29,067,000	2,842,000	30,792,000
Oats ...	2,744,000	22,983,000	2,726,000	26,355,000

The weather during the month ending with the middle of June was very favourable for the crops, especially for the winter seeds. The wheat and rye harvests promise to be very good, both in quality and quantity, and may exceed the amounts estimated above if the favourable conditions continue. The barley sown in the autumn will probably yield a good crop, but the development of the spring seeds has not been so good. Oats are the least satisfactory among cereals; in some parts of the country the seeds had to be ploughed and re-sown. The prospects for fruit vary in different parts, but an average crop is expected, especially in pears, apples, and plums.

Russia.—The reports on the condition of the crops are almost everywhere favourable, and a good harvest is expected. The official *Commercial and Industrial Gazette* of St. Petersburg of June 1st publishes a detailed report as to the state of the spring and winter grain crops in the whole of Russia up to the end of May.

Winter wheat is reported to promise in general an abundant crop. The prospects are excellent in the Governments of Kieff, Podolsk, and Kherson, in the three Northern Caucasian Governments, and in the Crimean districts of the Tavride. In the case of most of the other Governments, the prospects are good. Unsatisfactory indications come chiefly from Governments where the cultivation of winter wheat is not of great importance.

The winter rye crop promises to be above the average. Spring grain prospects are in general good for European Russia. The condition is unsatisfactory in a few separate localities.

The British Consul at Batoum reports, in a despatch dated June 9th, that the outlook for cereal crops in the Caucasus is very promising and the prospect of a prolific yield has sent down the prices of grain.

Hops in Russia and Poland.—The British Consul at Warsaw states in a report dated June 24th that early in May great heat, followed by cold, was experienced, and the effect of the sudden changes of temperature has been disastrous in the hop gardens. Volhynia and the Vistula districts especially have suffered. In woodland and low-lying land the hops have suffered less, and in the north-western districts the condition is excellent.

Holland.—The British Consul at Rotterdam reports that according to the last prospective review issued from the Dutch Ministry of Agriculture, strawberries, raspberries, and gooseberries are expected to be plentiful; but that cherries, plums, peaches, and currants appear to have suffered to a certain extent from changes of temperature. The condition and quantity of vegetables of all kinds are reported as satisfactory.

India.—The final general memorandum on the wheat crop given in the *Indian Trade Journal* of May 26th gives the area under wheat in 1909–10 as 27,765,500 acres, as compared with 26,045,100 acres in 1908–9, and an average of 27,901,500 in the five years ending 1907–8.

The yield is estimated at 9,557,000 tons, as compared with 7,593,600 tons in 1908–9.

Transvaal.—The Transvaal *Government Gazette* of May 6th states that the maize crop of the Transvaal this year is estimated at 232,000 tons. The surplus for export will probably be about 53,500 tons.

United States.—The United States Department of Agriculture estimates the average condition of winter wheat on July 1st at 81·5, compared with 80·0 last month, and a ten-year average of 81·3. Spring wheat is put at only 61·6, compared with 92·8 last month, and a ten-year average of 87·1. Oats have declined in condition from 91·0 last month to 82·2 on July 1st, and a still larger decline is reported for barley, from 89·6 to 73·7. As regards maize, preliminary returns show the area planted to be about 114,080,000 acres, an increase of 5,310,000 acres on last year. The average condition on July 1st was 85·4.

Agricultural Labour in England during June.

The Board of Agriculture and Fisheries have been furnished by the Board of Trade with the following report, based on returns from correspondents in various districts, on the demand for agricultural labour in June:—

Agricultural employment was regular until towards the end of the month, when rain somewhat interrupted the haymaking in a number of districts, and day labourers lost time in consequence. Haymaking, weeding, and hoeing caused a fairly good demand for such men; the supply however, was usually quite sufficient.

Northern Counties.—Employment was generally regular in these counties, few reports mentioning any loss of time. Day labourers were in fairly good demand for hoeing and singling the root crops, haymaking, and hoeing corn; the supply of such men was usually sufficient, but a little scarcity was reported from the Morpeth Union (*Northumberland*) and several districts in *Yorkshire.*

Midland Counties.—A few day labourers were reported to have lost time through rain in the last week of the month; otherwise employment was regular. Haymaking and hoeing caused a fair demand for day labourers. A scarcity of such men was reported in the Melton Mowbray (*Leicestershire*) and Daventry (*Northamptonshire*) Unions; generally, however, the supply was about equal to the demand. Some scarcity was reported of carters in the Pershore (*Worcestershire*) Union, of milkers in the Shipston-on-Stour (*Worcestershire*) Union, and of shepherds in the Bedford (*Bedfordshire*) Union.

Eastern Counties.—Employment was regular, except for a little interruption to haymaking at the end of the month. Weeding corn, haymaking, and hoeing roots provided a good deal of work for day labourers, and in several districts, particularly where there was much weeding and hoeing to be done, there were not enough men for requirements.

Southern and South-Western Counties.—A little time was lost by day labourers in several districts at the end of the month. When fine, there was generally a fair demand for these men, and all the labour available was employed in many districts; mention of a scarcity, however, was exceptional in the reports. An insufficient supply of men for permanent situations was reported from the Williton (*Somerset*) and the Dursley and Thornbury (*Gloucestershire*) Unions.

THE CORN MARKETS IN JUNE.

C. KAINS-JACKSON.

The downward movement in prices continued during the first three weeks of June, but the last week of the month manifested an improved tendency. Neither decline nor improvement, however, are of much consequence in themselves, for they were no more than reflections of news of crop prospects. The rally before the close of the month was largely influenced by a material reduction in the supplies on passage.

Wheat.—British wheat is more than 10*s.* cheaper on the year, but at this period in 1909 value was undoubtedly inflated, while to-day many, probably a majority of, observers regard it as unduly depressed. The arrivals of June have been in excess of requirements by perhaps 400,000 qrs.; the supply on passage has fallen from 3,950,000 qrs. to 2,900,000 qrs. Of British wheat, deliveries showed a substantial decline from May of this year, but were a good deal larger than for June of last season.

Average English wheat at the end of June made 29*s.* to 31*s.* for red, 32*s.* to 34*s.* for white (per 504 lb.). Indian, worth 33*s.* 6*d.* white, and 33*s.* red, on the last day of May, made these prices a month later, and seeing the liberal arrivals of the particular sort it may fairly be said that it met with appreciation all through June. Australian, worth 35*s.* 6*d.* on the first day of the month, realised 35*s.* on the last. Odessa Ghirka showed no change at 32*s.* 6*d.* per qr. The market has not been active for Manitoba, Californian, or Argentine. Foreign sorts range from 32*s.* to 36*s.*, with 34*s.* as a fair average.

Shipments for June were 630,000 qrs. from North America (largely from Canada); 353,000 qrs. from South America (mostly, as usual, Argentine); 537,000 qrs. from India; 1,710,000 qrs. from Russia; 225,000 qrs. from Roumania; and 180,000 qrs. from Australasia. These totals have exerted little influence, for Russia alone has exceeded anticipations, and the Continent has taken 75 per cent. of the Russian exports. What has depressed the markets has been the opinion that the wheat production of the North Temperate Zone in 1910 would largely exceed the average.

Flour.—The London top-price was reduced to 33*s.*, while cash terms for Town Whites and Households closed at 29*s.* 6*d.* and 26*s.* 6*d.* respectively. At these moderate quotations there was an improvement in retail business. Country flour at 23*s.* for Roller Whites has also had an augmented sale. The supply of foreign on passage is stationary, and below the average. North America in June shipped only 334,000 sacks. Prices for foreign on the last day of the month included 30*s.* for Minnesota, 25*s.* for Iron Duke, 39*s.* 6*d.* for choice Hungarian, and 26*s.* 6*d.* for f.a.q. Australian.

Barley.—A further fall of over a shilling on British samples is the more depressing as the average at the end of May was already very low. The poor quality of what is left of the 1909 crop appears to be the main cause of the depressed quotations. Russian barley has fallen 6*d.*, *i.e.*, from 18*s.* to 17*s.* 6*d.* At the latter remarkably reduced price it has a fair sale. Other imported sorts of barley are fetching 24*s.* per 400 lb., new crop Anatolian, variously described as Smyrna or Sea of

Marmora, from region of shipment, or as Ouchak, from the uplands, where much of it is grown. The price of Chilian is 29*s.* and 32*s.*, and of Californian brewing 30*s.* to 31*s.*; these prices are per 448 lb. June shipments were 1,949,000 qrs. from Russia; 126,000 qrs. from Europe, S.E.; 16,000 qrs. from California; and 15,000 qrs. from Chile. The quantity on passage, 390,000 qrs., is not heavy.

Oats.—There is no appreciable change in the average for home-grown oats. Argentine have been freely offered, and 13*s.* 6*d.*, the mean price on the 30th, was 3*d.* lower, from 13*s.* 9*d.*, the very low quotation on the first. Russian 304 lb., worth 15*s.* 3*d.* at the end of May, made 14*s.* 6*d.* for like quality on the last day of June, but for a better quality there was an improved sale at 16*s.* 6*d.* per 320 lb. Anything of fair to good weight, in fact, was appreciating rather than declining. June shipments were 149,000 qrs. from North America, 161,000 qrs. from South America, 517,000 qrs. from Russia, 48,000 qrs. from Chile, and 8,000 qrs. from Roumania. The supply on passage on the 30th, 330,000 qrs., showed 80,000 qrs. reduction on the month.

Maize.—The rainy period in Argentina came to an end with May, and the crop secured early in April has had a month's drying weather. It is now coming down to the seaboard in quantity, and affects the market situation in Great Britain. The offers to ship at a guinea per quarter, cost, freight and insurance, to London, tend to lower spot values while they continue, but the month did not close without signs of stronger holding in Argentina. London values on the last day of June were 25*s.* for old Argentine on spot, and 23*s.* new for August delivery. Odessa made 23*s.*, Natal 24*s.*, and American 25*s.* per qr. New small Cinquantina realised 31*s.* per qr. It can be used unsplit and unbroken for many feeding purposes. Shipments of maize for June were 87,000 qrs. from North America (small), 700,000 qrs. from South America (fair), 191,000 qrs. from Russia (fair), and 558,000 qrs. from Europe S.E. (unusually good). The supply on passage by the 30th had risen to 680,000 qrs., mainly in consequence of Argentine new crop shipments during the concluding fortnight.

Oilseeds.—There is more doing in these staples than a month ago. Indian linseed makes 57*s.* per 410 lb., and Argentine 56*s.* per 416 lb. The shipments for June from India were 404,000 qrs., while from Argentina only 118,000 qrs. cleared. Some buyers, therefore, are inclined to concentrate on Argentine. Indian brown rapeseed is held for 38*s.* per 416 lb. Cottonseed at £8 per ton for fine Egyptian is cheap by comparison with this year's prices, January to May inclusive. The new crop for November shipment is being held for £7 17*s.* 6*d.* per ton.

Oilcake.—At £7 17*s.* 6*d.*, the best London-made linseed cake is 12*s.* 6*d.* cheaper on the month, and should be well worth buying. The best cottonseed cake at six guineas is 5*s.* 3*d.* down, and similarly commends itself to the buyer with storage room. Soy bean cake on the 30th was selling steadily at £5 15*s.* per ton *ex mill.*

Various Feedingstuffs.—Beet sugar is scarce on spot, and commands 15*s.* per cwt. for prompt delivery. The price for November shipment from Hamburg or Trieste of North or South German is 11*s.* 9*d.* to 12*s.* per cwt. only. Canaryseed is dearer on the month, but may still be had for 42*s.* per quarter.

THE LIVE AND DEAD MEAT TRADE IN JUNE.

A. T. MATTHEWS.

Fat Cattle.—Between the last week in March and the 9th June the average price of prime Shorthorns advanced from 8*s.* $4\frac{1}{2}$*d.* per stone to 9*s.* $4\frac{1}{4}$*d.*, an increase nearly approaching $1\frac{1}{2}$*d.* per lb. The highest point was reached about the latter of these two dates, since which there was some decline, but scarcely more than could be accounted for by the ordinary circumstances attending the season when the stock of stall-fed bullocks is exhausted and the supplies are drawn from the pastures. There are a few markets, notably that of London, that continue to draw considerable numbers of stall-feds from Norfolk to a later date than others, and it was noticeable, during the week ending June 23rd, that the quotations at these places actually showed an advance, while nearly all others declined. This points clearly enough to the conclusion that the drop in average values which set in during the second week was chiefly owing to the intrinsic difference in value to the butcher between stall and grass-fed cattle. The average price of Shorthorns for the month in about twenty-three English markets was 9*s.* $2\frac{1}{2}$*d.* per stone for first, and 8*s.* 4*d.* for second quality, which shows an advance on the May figures of $3\frac{1}{2}$*d.* and 3*d.* respectively. The average for Herefords was 9*s.* $3\frac{1}{2}$*d.*, for Devons 9*s.* $2\frac{1}{2}$*d.*, and for Scots 9*s.* 6*d.*, these being the prices for first quality only.

Veal Calves.—The trade in veal calves continued steady and featureless. The average price of about twenty-six British markets began at $8\frac{1}{2}$*d.* and $7\frac{1}{2}$*d.* per lb., losing $\frac{1}{4}$*d.* by the end of the month. The dearest markets were in Wales and Scotland, where $9\frac{1}{2}$*d.* and even 10*d.* per lb. was touched, no English market exceeding $8\frac{3}{4}$*d.* in the third week.

Fat Sheep.—The markets have been fairly well supplied, and trade was of a very even character during the first three weeks, but towards the close there was a weakening tendency. Atmospheric changes have been sudden and frequent, with much close, thundery weather, which made buyers very cautious at times. The averages, however, work out very similarly to those of May, and when we consider that there is a larger proportion of heavy sheep as the summer advances, it may be taken that real values were very well maintained. Prime, small Downs were in good request, and sold well throughout in proportion to heavy sheep. The general average for these choice sheep in English markets was a fraction over 8*d.* per lb., that for second quality $7\frac{1}{4}$*d.*, and ewes $5\frac{3}{4}$*d.* The averages for Longwools were exactly $\frac{1}{2}$*d.* per lb. less than for Downs for all qualities. The London market was well over the general average for nice, small sheep, but towards the close coarse, heavy sheep were sold at relatively very low prices.

Fat Lambs.—Farmers throughout the country would seem to have been drawing heavily on their stock of lambs during June, London being especially over-supplied, and again appearing amongst the very lowest of all British markets for lambs. The trade became gradually worse during the month, the averages declining $\frac{1}{4}$*d.* per lb. each week.

Including the Scotch markets, which were much higher than the English, they were 11*d.* and 9¾*d.*, showing a fall of about 1*d.* per lb. on May prices.

Fat Pigs.—Notwithstanding the heat of the weather, which, at times, must have been very adverse for the curers, the high prices of May were nearly equalled for fat pigs, and the average of about thirty markets was 7*s.* 9*d.* for first, and 7*s.* 1½*d.* for second quality. This was about 3*d.* per 14 lb. less than the March averages.

Carcass Beef—British.—The depreciation in the price of Scotch sides relatively to that of port-killed American, which was recently the subject for much comment, was redressed during June, and prices have been more normal in their proportions. Short sides have averaged 7⅝*d.* and 7¼*d.* for first and second quality, while long sides fetched 7¼*d.* and 6⅞*d.* per lb. The best English sides averaged 6¾*d.*, and second quality 6⅜*d.* per lb.

Port-killed Beef.—Importations of live cattle continued light, but, probably owing to a falling off in quality of the American and the superior finish of British cattle, the condition of which was unusually good, the position of May was reversed, and the average Central Market prices were 6⅝*d.* and 6¼*d.* for first and second quality.

Chilled Beef.—Chilled beef from the United States came sparingly to hand, but Argentine supplies were heavy, and there was a considerable fall in prices. Argentine hindquarters ranged from 6½*d.* per lb. at the opening of the month to 4¾*d.* on the 15th, the average being 5½*d.* to 5*d.* for hindquarters, and 4¼*d.* to 3¾*d.* for forequarters. States chilled averaged 6¾*d.* for best hindquarters, and 5*d.* for best forequarters.

Frozen Beef.—There was more demand for frozen beef than in May, and in the first week it was extremely dear. Best hindquarters then sold at 5¾*d.* per lb., but declined gradually to 4*d.*

Carcass Mutton—Fresh Killed.—Scotch and English carcasses met a fair demand. The former ranged from 8*d.* to 8¾*d.* for first quality, the average for the month being 8⅜*d.* The average price of prime English in London was 7½*d.* Dutch mutton was on offer in rather large quantities, and depressed the value of home-killed. It fetched about ¾*d.* per lb. less than English, and, in the hot weather, came to hand in very bad condition.

Frozen Mutton.—With virtually unlimited supplies, this article was cheap, and the price for the very best New Zealand averaged 4*d.* per lb.

Carcass Lamb.—Although the trade for British lamb was sometimes very slow at Smithfield, the prices realised were relatively better than those of live lambs at Islington. The averages were 8⅝*d.* and 8⅛*d.* per lb. for first and second quality. The top price of finest New Zealand stood all the month at about 5¾*d.* per lb.

Veal.—The demand for veal in London was sluggish, and prime carcasses never fetched more than 7*d.* per lb. till the end of the month.

Pork.—Very little business was done in pork, but prices were firm for English at 7¼*d.* and 6¾*d.* per lb., small Dutch being only slightly cheaper.

THE PROVISION TRADE IN JUNE.

HEDLEY STEVENS.

Bacon.—Prices have fluctuated but little during the month, but on the whole they have closed slightly higher than at the end of the previous month. Arrivals from the Continent have been small, and although the consumptive demand continues to decrease, there is no accumulation of stock at any of the ports, on account of the diminished arrivals from all points. The shortage in the arrivals from the United States and Canada is more apparent, and those specially engaged in that section of the trade realise that they will be passing through a very critical time during the next three or four months. Advices from those countries report that now they are experiencing warm weather the country jobbers are forced to discontinue killing hogs, not having refrigerating plants. This diverts their trade to the large packing centres, where stocks in the cellars are abnormally small. This additional demand will naturally still further reduce the quantity available for export.

During the month there has been a little contracting by English houses for June and July shipments, and at very high prices; 82*s.* per cwt. c.i.f. terms has been paid for certain cuts, which last year at the same time were selling at about 63*s.* per cwt., and two years ago at about 46*s.* American hams on spot are making from 22*s.* to 25*s.* per cwt. over prices current last year. American lard was easier during the month, and proportionately cheaper than bacon, prices ranging from 4*s.* to 5*s.* per cwt. only over those of last year. Doubtless this has been caused by the smaller consumption of lard, as, on account of the high prices, lard substitutes are being freely used.

Russian and Manchurian bacon is arriving in larger quantities, the former selling freely on account of the improved quality, but the Manchurian still continues more or less unsatisfactory.

English and Irish curers report a fair trade, their goods being relatively the best value at present prices, but business is, of course, hampered by the continued difficulty of obtaining a sufficient number of pigs for slaughtering. As July and August are usually the largest consuming months, they anticipate that the real pinch of the shortage is yet to be felt, and still higher prices must be expected.

Cheese.—Contrary to expectations (with all fresh and cured meat so high in price) the consumptive demand for cheese has continued disappointingly small, more especially for new makes, there being plenty of last season's goods on hand, and at the difference in price they have been relatively better value. This has caused an accumulation of new makes at most points, and conditions being favourable for a large make, both in England and Canada, it is thought by many that present prices (although below those current last year) cannot be maintained.

A moderate amount of contracting was done with Canada during the first few days of the month for the best districts of June makes, at around 53*s.* c.i.f., which is about 2*s.* to 3*s.* under last year. Importers, however, stopped buying towards the end of month, as stocks

had still further increased, and they now look to fill their requirements at about 50*s*. The shipments from Canada so far are about the same as last year, but another factor which has helped in the accumulation of new Canadians is the good demand that has been experienced for New Zealands, which have been arriving in large quantities. At the end of the month there were three steamers on passage, with a total of 23,000 crates (say, 46,000 cheese). These are practically the last shipments of the season from that country. In London on June 30th the stock of New Zealand was 19,000 crates, against 9,000 at the same time last year. At the end of the month the estimated stocks of Canadian cheese at the three principal distributing centres (London, Liverpool, and Bristol) were 178,000 boxes, against 104,000 last year, and 99,000 two years ago. The London and Bristol stocks show nearly double those which existed last year.

In the United States prices are still above an export basis, full cream cheese making equal to 66*s*., 67*s*. delivered here, and skims 56*s*., 57*s*.

In English cheese the chief consumption has also been in last season's makes, there being fair stocks on hand. This has made the demand very slow for new makes, and prices are below those current last year.

Butter.—Arrivals have been large during the month, those from Siberia being far in excess of last year at the same time, and with pasturage conditions reported good, the arrivals from that country should continue to increase. The make in England and Ireland has been large, but with tinning operations in full swing, and fair quantities going into cold store, prices have been fairly maintained for all descriptions. New Zealand and Australian have experienced a fair demand.

The make of butter is increasing in Canada, as there is less cream going into the United States, but prices are still above an export basis. In the United States prices for ordinary finest creameries are around 134*s*. per cwt.

Eggs.—There has only been a moderate trade passing during the month. Continental prices have been such that the business has been unremunerative to dealers. The demand has been chiefly for strictly fresh parcels.

THE VEGETABLE TRADE OF LONDON.

W. W. GLENNY.

Potatoes.—Much of the first new potato trade is in foreign hands, and even as early as January Teneriffe sends large consignments in boxes. They come closely packed with a light material between the tubers which retains moisture, so that though the voyage occupies perhaps seven or eight days, yet they are as fresh and moist when received as if recently lifted out of the soil. A little later potatoes arrive from Algiers, Lisbon, Malta, Spain, and Southern France, and then from the Channel Islands, Cherbourg and St. Malo, Belgium, and Holland. Home-grown potatoes are not ready in the South of England until about July 1st. Prices for foreign sorts in the fourth week of June were, for Canary, 8*s*. to 8*s*. 6*d*. per cwt.; for St. Malo,

7*s*. per cwt.; for Cherbourg, 6*s*. per cwt.; and for Channel Islands, 6*s*. to 7*s*. per cwt. With so many countries consigning their surplus supplies to our ports, the grower of early potatoes is somewhat at a disadvantage. Old potatoes are now practically over for the season, as the new ones come into general use in July, the only demand being for workhouses and public institutions that cannot store unmatured tubers.

Throughout winter and spring the potato trade was dull, and the demand could at no time be called active. Dunbars, Langworthies, Scottish Triumphs, and Up-to-Dates led the way, at prices between 70*s*. and 80*s*. per ton, with others, such as British Queens, Royal Kidneys, and Evergoods, following at 50*s*. and 60*s*. per ton, varying according to the place of origin; while common varieties have changed hands at 40*s*. to 50*s*. per ton. With potatoes much depends on the soil, so that there is, first, the variety to be considered, then, secondly, the nature of the land where they grew. Thus we find that a common inquiry is, where do they come from? and potatoes are classified by locality, as Kent, Essex, Bedford, Lincoln, Yorkshire, Scotch, or Black-land, the latter coming from the Fen district.

Onions.—Onions figure largely in London markets, and are on sale in a dry condition, well harvested, during every month of the year. The annual consumption is enormous, for not only is the area cultivated at home very considerable, but there are substantial imports from abroad, the quantity received in the United Kingdom from abroad in 1909 being 7,470,000 bushels. Different foreign countries send onions at different periods of the year, so that there is seldom a lack of imported goods throughout the twelve months.

The succession of arrivals from abroad is roughly as follows:—Spain sends onions in cases from July to May. Their condition is perhaps not quite as good at the beginning or end of the season, but the growers in Valencia manage to harvest onions so well that, with the aid of a dry climate, they reach our shores in prime condition nine months out of twelve. No other country attempts such a continual output, and merchants regulate their exports with considerable exactness to meet the requirements of British trade. The weight of a case of Valencia onions is about 120 lb., and in May last, when these were in fine condition, the price was 10*s*. to 12*s*. per case. Egypt sends capital onions in bags from April to July. The weight is approximately 1 cwt., and at the end of June their value was 4*s*. 6*d*. to 5*s*. per bag. Among other exporters of onions, Belgium and Holland send their surplus harvest from September to the close of the year. Last season was wet, and owing to the unsettled weather the crop did not ripen well. Onions lie on the ground to mature after pulling, and with rain every few days they cannot be thoroughly dried, so that Belgian and Dutch onions never appeared in the best condition, and in November the price only reached about 3*s*. 6*d*. and 4*s*. per cwt.

France, Germany, and Portugal all send onions at different times when London markets can attract them by a good price.

The home-grown crop of onions was middling, though it also suffered from the rainy season. When onions are pulled up the last week in August there is a thick bine or top attached to the bulb; this is at first green, and the onions require field room until this green top is withered up. This process takes on an average about a month,

and until the top is shrivelled up and perfectly dry, the crop cannot be harvested with any degree of confidence. The harvest of 1909 was in consequence very trying, and the earliest onions to reach the market were in indifferent condition, and realised poor prices. Until these were disposed of trade was depressed and prices low, but with the beginning of the current year an improvement set in, and from £4 to £5 per ton was about an average for best quality, which, considering the extent of outside competition, was satisfactory.

Peas.—This vegetable is imported in baskets and bags from Guernsey and France long before the pods are filled in this country. Guernsey sends produce in handle baskets of superior quality to those of French origin. Some from Montauban (Tarn-et-Garonne), about thirty-one miles from Toulouse, France, were sold in Covent Garden Market early in June at 4*s*. 6*d*. per bag of 40 lb. weight. These peas were mostly shelled in the market, and sold to restaurant proprietors. English peas were worth at the close of June about 2*s*. 6*d*. or 3*s*. 6*d*. per bushel, or 5*s*. to 6*s*. per sack. Growers often pack peas in bushel baskets, while jobbers or dealers who purchase from farmers often have the peas picked by roving gangs; these wandering pickers pack them in bags or sacks, but they do not usually gather the pods with the care necessary to secure an even sample. Thus bag peas are purchased by small retailers and costermongers, while sieve peas of superior class are secured by West End shopkeepers for better class customers.

Asparagus.—Trade has been on the whole fair, and prices maintained better than in some years. Best bundles, or Ware, of 100 or 120 buds have fetched prices from 2*s*. 6*d*. to 3*s*., while middling quality, or Sprue, which is generally green in colour, have ranged from 1*s*. to 1*s*. 6*d*. per bundle.

Cauliflowers.—Cauliflowers and White Broccoli, formerly considered distinct vegetables, now arrive in a continuous stream throughout the year. At present home-grown ones are worth 2*s*. to 3*s*. per dozen heads, which is a satisfactory price to the grower. Doubtless the fact that cabbages were not quite so abundant as usual has helped their sale this season. A short time ago there were consignments of fine cauliflowers from Roscoff, in Brittany, which realised high prices.

Cornish broccoli, called cauliflower, is cultivated successfully near Penzance, and dispatched to London to some extent, while Bristol, Birmingham, and South Wales also get a proportion of the trade. Italy sends cauliflowers to London in small chip baskets containing 1½ dozen, or 18 heads, and these come in the winter months, though in severe weather they are liable to be touched by frost and of little value. They sometimes fetch 5*s*. or 6*s*. a basket, but this winter many baskets were sold at 1*s*. 6*d*. or 2*s*., and the season was a poor one for the growers.

Cabbages.—On account of a cold spring cabbages were slow to mature, and really fine ones are only now coming in. The price has varied between 6*d*. and 1*s*., according to size and substance, which is better than in many years. On the whole markets have been well supplied during the first six months of the current year.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and SCOTLAND in the Month of June, 1910.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	England.		Scotland.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK :—	per stone.*	per stone.*	per cwt.†	per cwt.†
Cattle :—	s. d.	s. d.	s. d.	s. d.
Polled Scots	9 6	9 0	44 1	40 5
Herefords	9 3	8 5	—	—
Shorthorns	9 2	8 3	43 1	39 9
Devons	9 2	8 4	—	—
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	8½	7½	9	7
Sheep :—				
Downs	8¼	7¼	—	—
Longwools	7½	6¾	—	—
Cheviots	9	8¼	9½	8¼
Blackfaced	8¾	8	8¾	7¾
Cross-breds	8¼	7½	9½	8½
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs :—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	7 8	7 2	7 10	6 11
Porkers	8 1	7 7	8 2	7 4
LEAN STOCK :—	per head.	per head.	per head.	per head.
Milking Cows :—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	21 12	17 18	22 8	18 1
,, —Calvers... ...	21 4	17 17	20 3	17 1
Other Breeds—In Milk ...	19 18	15 6	19 7	16 4
,, —Calvers ...	13 10	12 0	18 17	16 3
Calves for Rearing	2 9	1 17	2 18	2 0
Store Cattle :—				
Shorthorns—Yearlings ...	10 19	9 8	10 18	9 8
,, —Two-year-olds...	15 4	13 5	15 13	13 13
,, —Three-year-olds	18 9	16 0	17 3	14 18
Polled Scots—Two-year-olds	—	—	17 6	15 0
Herefords— ,,	16 1	14 4	—	—
Devons— ,,	14 14	13 0	—	—
Store Sheep :—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	39 8	34 5	—	—
Scotch Cross-breds ...	—	—	37 1	32 6
Store Pigs :—				
Under 4 months	33 4	26 8	28 10	22 3

* Estimated carcase weight.

† Live weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND and SCOTLAND in the Month of June, 1910.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Quality.	Birmingham.	Liverpool.	London.	Manchester.	Edinburgh.	Glasgow.
		per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.
BEEF:—							
English	1st	62 6	63 0	63 0	64 0	66 6*	67 0*
	2nd	58 6	59 6	60 0	61 6	59 6*	64 6*
Cow and Bull ...	1st	55 0	53 0	53 6	56 6	55 6	56 6
	2nd	49 6	45 0	49 6	52 0	49 6	48 0
U.S.A. and Canadian:—							
Port Killed ...	1st	65 6	62 6	61 6	62 6	—	64 0
	2nd	60 6	59 6	59 0	59 6	—	61 6
Argentine Frozen—							
Hind Quarters...	1st	46 6	45 0	44 0	45 0	46 6	45 0
Fore ,, ...	1st	37 6	36 0	36 0	36 0	36 6	37 0
Argentine Chilled—							
Hind Quarters...	1st	51 0	49 0	50 0	49 0	50 6	51 0
Fore ,, ...	1st	39 0	38 0	37 0	38 0	38 0	40 6
American Chilled—							
Hind Quarters—	1st	—	64 6	63 6	64 6	62 0	—
Fore ,, ...	1st	—	45 6	45 6	45 6	46 0	—
VEAL:—							
British	1st	64 6	74 0	66 6	69 0	—	—
	2nd	59 6	65 6	61 6	64 6	—	—
Foreign	1st	—	—	67 0	—	67 0	—
MUTTON:—							
Scotch	1st	—	79 0	78 0	78 0	75 6	82 0
	2nd	—	74 0	73 6	73 6	62 0	66 6
English	1st	66 6	73 6	69 6	73 6	—	—
	2nd	53 0	68 6	65 6	68 0	—	—
Argentine Frozen ...	1st	35 0	33 0	33 6	33 0	33 6	34 0
Australian ,, ...	1st	33 6	31 6	33 6	31 0	—	32 6
New Zealand ,, ...	1st	36 0	—	37 0	—	—	—
LAMB:—							
British	1st	78 0	80 6	80 6	81 0	87 6	93 6
	2nd	73 6	72 0	75 6	76 6	76 6	85 0
New Zealand ...	1st	55 6	54 0	53 6	55 6	57 0	56 0
Australian	1st	52 6	49 0	49 0	49 6	—	49 0
Argentine	1st	50 6	50 6	48 6	50 6	51 6	49 0
PORK:—							
British	1st	67 0	64 0	67 0	63 6	64 6	66 6
	2nd	63 0	56 0	62 6	59 0	58 0	62 0
Foreign	1st	—	—	65 6	—	—	—

* Scotch.

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1908, 1909 and 1910.

Weeks ended (*in* 1910)	WHEAT.			BARLEY.			OATS.		
	1908.	1909.	1910.	1908.	1909.	1910.	1908.	1909.	1910.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. a.*
Jan. 1 ...	35 1	32 0	33 3	26 9	26 7	25 1	18 4	17 4	17 4
,, 8 ...	35 2	32 9	33 6	26 9	26 11	24 11	18 3	17 5	17 2
,, 15 ...	35 5	32 8	33 8	27 1	27 1	24 11	18 5	17 5	17 7
,, 22 ...	35 6	33 2	33 9	26 11	27 3	24 11	18 5	17 8	17 6
,, 29 ...	35 0	33 0	33 6	26 11	27 6	25 0	18 4	17 9	17 4
Feb. 5 ...	34 3	33 4	33 7	26 9	27 7	24 10	18 3	17 10	17 7
,, 12 ...	33 1	33 8	33 4	26 9	27 8	24 9	18 0	17 11	17 11
,, 19 ...	32 6	34 1	33 0	26 5	27 11	24 6	17 11	18 0	18 0
,, 26 ...	30 11	34 5	32 7	26 3	28 0	24 2	17 8	18 0	17 10
Mar. 5 ...	30 5	34 10	32 7	26 1	27 11	24 6	17 8	18 2	18 1
,, 12 ...	31 3	35 8	32 6	26 0	28 4	24 1	17 10	18 2	18 0
,, 19 ...	31 7	35 9	32 6	26 2	28 0	23 6	17 11	18 5	18 0
,, 26 ...	31 4	36 0	32 9	25 10	28 0	23 7	17 10	18 6	17 11
Apl. 2 ...	31 3	36 5	33 0	25 5	27 10	23 8	17 9	18 8	18 0
,, 9 ...	31 2	37 4	33 6	25 10	28 0	23 1	17 7	18 10	17 11
,, 16 ...	30 11	38 7	33 7	26 1	27 8	23 5	17 7	19 2	18 3
,, 23 ...	30 10	41 4	33 7	25 5	28 2	23 0	17 9	19 9	18 3
,, 30 ...	31 6	42 5	33 0	25 8	27 10	22 10	18 0	20 0	18 3
May 7 ...	32 4	40 9	32 6	25 5	27 7	22 7	18 4	20 3	18 2
,, 14 ...	33 1	41 6	32 1	24 9	27 3	22 0	18 7	20 6	18 1
,, 21 ...	33 8	42 8	31 10	25 9	27 0	21 8	18 10	20 11	17 8
,, 28 ...	33 5	42 6	31 3	24 6	26 3	21 4	18 8	21 0	17 10
June 4 ...	33 1	43 1	30 2	25 10	25 7	21 8	18 4	21 3	17 10
,, 11 ...	32 7	42 11	29 1	24 5	26 10	20 9	18 4	21 4	17 10
,, 18 ...	32 0	42 7	29 0	24 2	26 10	18 11	18 5	21 6	18 0
,, 25 ...	31 5	42 8	29 4	24 0	27 2	20 1	18 7	21 7	17 9
July 2 ...	30 11	42 9	29 9	23 11	27 2	19 11	18 7	21 9	17 7
,, 9 ...	30 5	43 0	30 4	24 4	26 4	19 5	18 5	21 8	17 4
,, 16 ...	30 7	43 3		23 1	26 10		18 5	21 9	
,, 23 ...	31 5	44 0		26 5	27 4		18 6	22 5	
,, 30 ...	31 10	43 5		24 4	24 6		18 7	22 2	
Aug. 6 ...	31 6	44 9		23 1	27 4		18 9	22 11	
,, 13 ...	31 6	44 9		23 10	24 9		18 1	21 8	
,, 20 ...	31 2	41 6		24 5	23 11		17 10	19 8	
,, 27 ...	30 10	38 5		24 5	24 7		17 1	19 4	
Sept. 3 ...	30 10	37 2		25 5	26 3		17 3	19 6	
,, 10 ...	31 5	34 11		25 11	26 1		17 6	18 5	
,, 17 ...	31 7	33 6		26 0	26 5		17 3	17 9	
,, 24 ...	31 5	32 9		26 8	26 8		17 2	17 7	
Oct. 1 ...	31 7	32 2		26 11	26 9		17 2	17 2	
,, 8 ...	31 5	31 8		27 5	26 9		17 0	17 0	
,, 15 ...	31 2	31 4		27 6	27 0		17 0	17 0	
,, 22 ...	30 11	31 8		27 5	27 7		16 11	16 11	
,, 29 ...	30 8	31 10		27 5	27 9		16 11	17 0	
Nov. 5 ...	30 11	32 5		27 6	27 9		17 0	17 0	
,, 12 ...	31 2	32 5		27 4	27 7		17 0	17 1	
,, 19 ...	31 10	32 7		27 3	27 0		17 3	17 4	
,, 26 ...	32 3	33 0		27 2	26 8		17 5	17 3	
Dec. 3 ...	32 7	33 3		27 2	26 1		17 4	17 4	
,, 10 ...	32 8	33 3		27 0	25 7		17 4	17 3	
,, 17 ...	32 9	33 2		26 9	25 3		17 3	17 4	
,, 24 ...	32 2	33 1		26 8	25 2		17 2	17 4	

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lbs.; Barley, 50 lbs.; Oats, 39 lbs. per Imperial Bushel.

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE, BELGIUM, and GERMANY, and at PARIS, BERLIN, and BRESLAU.

—		Wheat. 1909.	Wheat. 1910.	Barley. 1909.	Barley. 1910.	Oats. 1909.	Oats. 1910.
		s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
France:	May	42 5	42 1	27 4	25 9	23 4	21 10
	June	44 6	41 10	28 5	25 5	24 9	21 4
Paris:	May	45 4	44 0	23 3	24 8	24 0	22 3
	June	46 7	42 6	25 5	24 4	27 2	20 6
Belgium:	April	40 6	35 11	26 8	23 1	22 4	19 10
	May	42 5	35 4	26 10	23 8	23 3	20 1
Germany:	April	50 3	46 7	31 7	25 9	25 1	21 0
	May	52 9	44 0	30 6	24 10	26 1	20 7
Berlin:	April	51 11	48 3	—	—	25 0	21 11
	May	55 6	46 1	—	—	25 5	20 10
Breslau:	April	47 11	44 10	32 6 (brewing) 26 0 (other)	25 4 (brewing) 24 2 (other)	23 8	20 0
Breslau:	May	51 6	41 0	32 6 (brewing) 26 0 (other)	25 4 (brewing) 23 3 (other)	25 3	19 6

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*, the prices for the German Empire representing the average of the prices at a number of markets.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of June, 1909 and 1910.

—	Wheat. 1909.	Wheat. 1910.	Barley. 1909.	Barley. 1910.	Oats. 1909.	Oats. 1910.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
London	42 10	29 9	27 5	20 11	21 9	19 2
Norwich	42 9	29 6	26 10	22 3	20 10	17 0
Peterborough	41 5	28 0	—	18 10	21 0	17 1
Lincoln	42 1	29 5	—	—	21 6	17 3
Doncaster	42 1	28 6	26 1	22 4	21 4	17 9
Salisbury	43 3	28 8	24 9	20 7	21 1	16 4

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND and SCOTLAND in the Month of June, 1910.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Bristol.		Liverpool.		London.		Glasgow.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British ..	13 3	12 3	—	—	12 9	11 3	14 0	—
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery	110 0	107 0	105 0	102 6	107 6	104 0	107 0	—
,, Factory	99 6	95 0	95 0	89 0	101 0	97 6	—	—
Danish ..	—	—	115 0	112 6	115 6	113 0	114 6	—
Russian ...	106 0	103 0	102 6	99 0	101 6	99 6	104 0	100 0
Australian ...	105 6	101 0	103 0	101 0	103 0	101 0	105 0	99 6
New Zealand	113 0	108 0	—	—	108 0	105 0	111 0	—
Argentine ...	109 6	107 0	101 0	99 0	105 0	101 0	—	—
CHEESE :—								
British—								
Cheddar ...	74 0	62 6	74 0	72 0	73 6	68 6	51 0	48 0
			120 lb.	120 lb.	120 lb.	120 lb.		
Cheshire ...	—	—	61 6	56 6	67 6	61 0	—	—
			per cwt.	per cwt.	per cwt.	per cwt.		
Canadian ...	59 0	55 6	59 6	55 6	63 6	61 0	59 0	55 0
BACON :—								
Irish	79 6	77 6	79 6	75 6	80 0	78 0	80 0	77 6
Canadian ...	76 6	74 6	74 6	72 6	77 0	—	76 6	75 0
HAMS :—								
Cumberland ...	—	—	—	—	113 0	106 6	—	—
Irish	—	—	—	—	105 6	99 6	100 0	93 6
American (long cut) ...	84 0	81 0	84 6	79 0	81 6	78 0	83 0	81 0
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British ...	9 2	8 4	—	—	10 0	8 11	—	—
Irish	7 8	7 6	8 4	7 2	8 6	7 8	7 9	7 4
Danish ...	—	—	8 5	—	9 7	7 11	8 8	7 7
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Langworthy ...	63 6	57 6	71 6	61 6	64 0	50 0	52 0	46 0
Scottish Triumph	58 0	50 0	48 6	41 6	62 6	52 6	—	—
Up-to-Date ...	67 0	52 0	51 0	45 0	65 0	54 6	42 0	37 0
HAY :—								
Clover ...	95 0	80 0	107 6	80 0	97 6	75 0	90 6	85 6
Meadow ...	80 0	65 0	—	—	88 0	67 6	—	—

DISEASES OF ANIMALS ACTS, 1894 to 1909.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(*From the Returns of the Board of Agriculture and Fisheries.*)

Disease.	June.		Six Months ended June.	
	1910.	1909.	1910.	1909.
Swine-Fever :—				
Outbreaks	162	173	731	911
Swine Slaughtered as diseased or exposed to infection ...	1,292	1,239	6,508	8,226
Anthrax :—				
Outbreaks	113	90	814	720
Animals attacked	130	118	984	956
Glanders (including Farcy) :—				
Outbreaks	21	37	181	299
Animals attacked	86	144	508	1,171
Sheep-Scab :—				
Outbreaks	3	8	315	456

IRELAND.

(*From the Returns of the Department of Agriculture and Technical Instruction for Ireland.*)

Disease.	June.		Six Months ended June.	
	1910.	1909.	1910.	1909.
Swine-Fever :—				
Outbreaks	13	22	57	50
Swine Slaughtered as diseased or exposed to infection ...	293	443	1,346	797
Anthrax :—				
Outbreaks	—	—	4	3
Animals attacked	—	—	7	3
Glanders (including Farcy) :—				
Outbreaks	-	—	1	—
Animals attacked	—	—	2	—
Sheep-Scab :—				
Outbreaks	5	12	332	285

SELECTED CONTENTS OF PERIODICALS.

Horticulture—

Die Widerstandsfähigkeit der einzelnen Organe der Obstblüte insonderheit des Blütenpollens gegen Frost, *Dr. Ewert.* (Ztschr. Pflanzenkrank., Vol. XX., No. 2, 1910.)

Plant Diseases—

Contribution à la connaissance des champignons destructeurs du Bois, *C. Rumbold.* (Ann. Sci. Agron., 3 Ser., 5 Vol., No. 5, 1910.)

Über die durch *Chrysophlyctis endobiotica* hervorgerufene Kartoffelkrankheit, *E. Zimmermann.* (Naturw. Ztschr. Forst u. Landw., Vol. VIII., No. 6, 1910.)

Fourth Annual Report of the Honorary Consulting Zoologist to the Land Agents' Society, *W. E. Collinge.* (Jour. Land Agents' Soc., Vol. IX., No. 6, 1910.)

Das Auftreten des amerikanischen Stachelbeermehltaues in Belgien, *E. Marchal.* (Ztschr. Pflanzenkrank., Vol. XX., No. 4, 1910.)

Information about Spraying for Orchard Insects, *A. L. Quaintance.* The Development of Farm Crops Resistant to Disease, *W. A. Orton.* (Yearb. U.S. Dept. Agric., 1908.)

Live Stock—

Le Cheval belge, *A. Grégoire.* (Rev. Écon. internat., 7th year, Vol. II., No. 2, 1910.)

Dairying—

Technique Fromagère Théorie et Pratique, *P. Mazé.* (Ann. Inst. Pasteur, Vol. XXIV., No. 5, 1910.)

Veterinary Science—

Recent Work of the Bureau of Animal Industry Concerning the Cause and Prevention of Hog Cholera, *M. Dorset.* (Yearb. U.S. Dept. Agric., 1908.)

Birds, Poultry, Bees, &c.—

Useful Information as to the Rearing, Profitable Management, and Marketing of Farm Poultry, and its Relation to the Farmer's Home. Rpt. Kansas State Bd. Agric., Vol. XXIX., No. 113, 1910.)

The Economic Value of Predaceous Birds and Mammals, *A. K. Fisher.* Mouse Plagues, their Control and Prevention, *S. E. Piper.* The Relation between Birds and Insects, *F. E. L. Beal.* Use of Poisons for Destroying Noxious Mammals, *D. E. Lantz.* (Yearb. U.S. Dept. Agric., 1908.)

Forestry—

Forestry Notes, *W. Dallimore.* (Kew Bull., No. 1, 1910.)

Engineering—

M'Ainsh-Robertson Stack Rack, *Professor Stanfield.* (Trans. Highland and Agr. Soc. Scotland, 5th Ser., Vol. XXII., 1910.)

Road Construction and Maintenance, *R. F. Grantham.* Additional Remarks on Road Maintenance, *W. Menzies.* (Trans. Surv. Inst., Vol. XLII., Pt. X., 1910.)

Some Relations of Meteorology with Agriculture, *H. Mellish.* (Quart. Jour. Roy. Met. Soc., Vol. XXXVI., No. 154, 1910.)

Cost and Methods of Transporting Meat Animals, *F. Andrews.* Instruments for Making Weather Observations on the Farm, *D. A. Seeley.* (Yearb. U.S. Dept. Agric., 1908.)

ADDITIONS TO THE LIBRARY.

[NOTE.—The receipt of *annual* publications of foreign agricultural and other departments, experiment stations and societies is not noted in the monthly list of additions to the Library. A list of these publications appeared in the *Journal* for October, November, and December, 1909.]

Agriculture, General and Miscellaneous—

University of Illinois, Agricultural Experiment Station.—Circ. 142 :—European Practice and American Theory concerning Soil Fertility (31 pp.). Urbana, Ill., 1910.

U.S. Dept. of Agriculture, Bureau of Soils.—Bull. 58 :—The Composition of Commercial Fertilisers (39 pp.). Washington, 1910.

U.S. Dept. of Agriculture.—Farmers' Bulletin, No. 393 :—Habit-forming Agents : Their Indiscriminate Sale and Use as a Menace to the Public Welfare (19 pp.). Washington, 1910.

U.S. Dept. of Agriculture, Office of Experiment Stations.—Bull. 225 :—Proceedings of the Fourteenth Annual Meeting of the American Association of Farmers' Institute Workers, August, 1909 (52 pp.) [B. 44]. Circ. 97 :—Institutions in the United States giving Instruction in Agriculture (15 pp.) Washington, 1910.

Seffer, P. Olsson-.—La Agricultura en Varios Paises Tropicales y Subtropicales. Parte I., La Ciencia y la Agricultura (49 pp.). Mexico, Secretario de Fomento, 1910.

Henslow, G.—British Wild Flowers (318 pp.). London : S.P.C.K., 1910. 8*s.*

U.S. Dept. of Agriculture, Bureau of Plant Industry.—Circ. 63 :—Methods of Legume Inoculation (5 pp.). Washington, 1910.

Virginia Agricultural Experiment Station.—Bull. 187 :—Lime for Virginia Farms (48 pp.). Blacksburg, Va., 1910.

Memoirs of the Geological Survey, England and Wales.—The Water Supply of Hampshire (252 pp.). London : E. Stanford, 1910. 5*s.*

Imperial Institute.—Selected Reports from the Scientific and Technical Department. III., Foodstuffs. [Cd. 5137.] (200–267 pp.) London : Wyman and Sons, 1910. 3½*d.*

Field Crops—

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U.S. Dept. of Agriculture.—Farmers' Bulletin, No. 395 :—Sixty-Day and Kherson Oats (27 pp.). Washington, 1910.

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Sudan Government, Agriculture and Lands Department.—Report on Milling and Baking Tests of Some Sudan Wheats (8 pp.). Khartoum : El-Sudan Press, 1909.

U.S. Dept. of Agriculture, Bureau of Plant Industry.—Circ. 57 :—The Cultivation of Hemp in the United States (7 pp.). Bull. 179 :—The Florida Velvet Bean and Related Plants (26 pp. and plates). Washington, 1910.

West of Scotland Agricultural College.—Bull. 53 :—Report on an Experiment on the Cultivation of Lucerne in Scotland and on the Effects of Inoculation (159–170 pp.). Glasgow, 1910.

Martineau, G.—Sugar (149 pp.). London : Sir Isaac Pitman and Sons, Ltd., n.d. 1*s.* 6*d.* net.

Plant Diseases—

Massee, G.—Diseases of Cultivated Plants and Trees (602 pp.). London: Duckworth and Co., 1910. 7*s.* 6*d.* net.

University of Wisconsin, Agricultural Experiment Station.—Bull. 190:—Common Insect Pests of Fruit in Wisconsin (38 pp.). Madison, Wisconsin, 1910.

U.S. Dept. of Agriculture, Bureau of Entomology.—Bull. 64, Part VIII.:—The Woolly White-Fly: A New Enemy of the Florida Orange (65–71 pp.). Bull. 82, Part IV.:—The Life-History and Control of the Hop Flea-Beetle (*Psylliodes punctulata*, Melsh) (32–58 pp.). Bull. 85, Part IV.:—The Sorghum Midge (*Contarinia* [*Diplosis*] *sorghicola*, Coq) (39–58 pp.). Washington, 1910.

Italy, Ministerio di Agricoltura, Industria e Commercio.—Annali di Agricoltura, N. 261:—Alterazioni del Granoturco e loro Profilassi (38 pp. and plates). Rome: G. Bertero, 1909.

Iowa College of Agriculture Experiment Station.—Bull. 111:—The Apple Leaf Hopper (32 pp.). Ames, Iowa, 1910.

*Cambridge Natural History.**—Vol. I.:—Protozoa, by M. Hartog; Porifera (Sponges), by I. J. B. Sollas; Coelenterata and Ctenophora, by S. J. Hickson; Echinodermata, by E. W. MacBride. (671 pp.) 1906.

Vol. II.:—Flatworms and Mesozoa, by F. W. Gamble; Nemertines, by L. Sheldon; Thread-worms and Sagitta, by A. E. Shipley; Rotifers, by M. Hartog; Polychaet Worms, by W. B. Benham; Earthworms and Leeches, by F. E. Beddard; Gephyrea and Phoronis, by A. E. Shipley; Polyzoa, by S. F. Harmer. (560 pp.) 1910. [E. 40]

Vol. III.:—Molluscs, by Rev. A. H. Cooke; Brachiopods (Recent), by A. E. Shipley; Brachiopods (Fossil), by F. R. C. Reed. (535 pp.) 1895. London: Macmillan and Co., 17*s.* net each volume.

Virginia Agricultural Experiment Station.—Bull. 188:—The Use of Lime Sulphur Sprays in the Summer Spraying of Virginia Apple Orchards (16 pp.). Blacksburg, Va., 1910.

Birds, Poultry, Bees, &c.—

Brown, E.—Poultry Fattening (102 pp.). London: Brown, Dobson and Co., 1910. 1*s.* net.

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Johnson, A. T.—The Poultry Keeper's Companion (181 pp.). London: Mills and Boon, Ltd., 1910. 2*s.* 6*d.* net.

Secrets of Successful Poultry Keeping (37 pp.). Bamber Bridge, Lancs: Leets and Co., 1910. 1*s.* net.

U.S. Dept. of Agriculture.—Farmers' Bulletin, No. 396:—The Muskrat (38 pp.). Washington, 1910.

U.S. Dept. of Agriculture, Bureau of Biological Survey.—Circ. 72:—Private Game Preserves and their Future in the United States (11 pp.) Circ. 73:—Progress of Game Protection in 1909 (19 pp.). Washington, 1910.

*The Cambridge Natural History.**—Vol. VIII.:—Amphibia and Reptiles, by Hans Gadow (668 pp.). Vol. X.:—Mammalia, by F. E. Beddard (605 pp.). London: Macmillan and Co., 1909. 17*s.* net each.

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Schlich, W.—Manual of Forestry. Vol. II. :—Sylviculture. Fourth edition, revised (424 pp.). London: Bradbury, Agnew and Co., 1910. 9*s.* net.

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COOMBE PLANTATION, KESWICK:
A Successful Plantation at a High Altitude.
(*Continued.*)

R. L. Robinson, B.A., B.Sc., and A. Lindsay Watt, F.S.I.

Financial Aspect.

In reviewing the financial results of a plantation of this nature, where the land may or may not be used for a future crop, and where the grazing value of the land is but little impaired, compared with virgin land, after the removal of the crop, the first consideration is the use of the soil throughout the rotation. For the purposes of a single rotation the land might obviously be bought outright, in which case a sum representing its value at the end of the rotation must be credited to the "returns," or the use of the soil for growing the crop might be rented on the basis of the value of the land for sheep-grazing.

Calculations have been carried out on both these assumptions, as the results give a useful comparison of the returns from the land under the two methods of management—forestry and sheep-grazing.

Expenses.—A valuation made in 1860 put the freehold value of the land, without the crop of timber it then carried, at £200, or approximately £1 per acre. The amount, at 3 per cent. compound interest, of £200 paid in 1848 is £1,213 13*s.*, but as the land still has a value (£200) now that it is being cleared of timber, the sum so accumulated is £1,013 13*s.*

On the other hand, the total amount of the annual rents would be £4,021 13*s.* The rent has varied somewhat from period to period. From 1848 to 1857 it was estimated at £15; from 1858–1867 at £20; 1868 to 1882, £40; 1883–1902, £20; 1903–1909, £15. The plantation has been let

as part of a farm, and the rents have been calculated, in proportion to area, on the total rent received from the farm. Undoubtedly the value of the rents so arrived at for the plantation is too high, since £200 represents only ten years' purchase on £20, but the result gives, at least, the maximum return which could be expected from the land under sheep. It must be pointed out also, that the plantation has a particular value from the grazing point of view, since it affords the only shelter on these hills.

The total cost of forming the plantation in 1848 was £565 10*s*. for 198 acres, or £2 17*s*. 2*d*. per acre. This amount was made up of £91 17*s*. 8*d*. for fencing (including the material used), £53 12*s*. 4*d*. for roads and drains, and £420 for the actual planting, *i.e.*, 9*s*. 4*d*., 5*s*. 5*d*., and £2 2*s*. 5*d*. per acre respectively for these items. Compared with the present cost of planting, the sum is small. The work was done by contract, under the terms of which the planting had to be completed in two years, and the blanks completely filled up at the end of ten years. It is not altogether easy to account for the relative prices of planting in 1848 and at the present time. As far as is known, the plants were notched in four feet apart, and the planters were paid 18*s*. a week. It is stated, however, that seedling larch could then be obtained at about one-half the present rate.

The amount at 3 per cent. compound interest to 1909 of all superintendence, upkeep, and general expenses is £10,087. The chief item under this head is "peeling of larch bark," so that this sum is misleading. Unfortunately, it has not been found possible from the records to separate out the details of this expenditure, as only the total sum expended has been shown. The cost of superintendence has probably averaged £15 per annum over the whole rotation, or approximately 1*s*. 6*d*. per acre. The question of barking larch will be referred to again later.

Rates and Taxes.—From 1848 until 1876, when the plantation was first opened to grazing, no rates were paid. From 1876 until 1903 the rate was 1*s*. 8*d*. in the pound on the assessed grazing value, and from 1903 until the present date 4*s*. 8*d*. in the pound. The total amount of all rates calculated to 1909 is £130 15*s*.

Table IV. has been constructed to show the costs and

returns in any one year, and these sums have been worked out at 3 per cent. compound interest to their amounts in 1909, and the results placed in parallel columns.

Returns.—The first yields from the plantation were obtained in 1856, 1857, and 1858, when a few young plants were removed and sold. Thinnings were begun in the year 1859, when the plantation was eleven years old. Until 1866 details of the yields are not available, but include, presumably, small larch thinnings and bark. From 1866 onwards full details have been kept, and these have been summarised on pp. 361–5. The general method of selling was to bark the trees and sell the bark and timber separately, the timber ("peeled larch") being sold at so much per ton of bark obtained from it.

These details, together with the chief expenses, have been summarised into five-yearly periods from the formation of the plantation onwards, in Table V. The volume of larch in cubic feet has been obtained from the weight of bark sold by assuming that one ton of bark is associated with 265 cubic feet of larch timber. This figure was found by experiments carried on in the plantation some years ago, but, of course, cannot be used with any great accuracy, since it would naturally vary with the age and size of the trees under consideration.

The *net* amount calculated to 1909 of all sales of bark during the sixty-one years is £2,019 8*s*. This amount should be noted, as the sale of bark is no longer profitable.

From 1868–1872, £4 to £4 10*s*. was obtained for larch bark, and in 1876 the maximum of £5 5*s*. per ton. Oak bark at the same time brought £7 7*s*. per ton. Since that time there has been a gradual fall in prices, so that larch bark brought £5 to £3 10*s*. per ton in 1878–1882; £3 10*s*., 1883 to 1892; £3 10*s*. to £3 5*s*., 1893–1897; £3 5*s*. to £2 15*s*., 1898–1902; £2 15*s*. to £2 5*s*., 1903–1907; while the present value is £2 5*s*. per ton. The estimated cost of felling and peeling is about £2 10*s*. per ton., so that the profit has not been nearly as great as would be expected from the details of the sales. The net return from this source has therefore shown a gradual decline for the last thirty years or so, until in 1903 there was a total loss of £5, and in 1906 of £5 10*s*. for the year. Since the latter date the timber merchant has done the felling and barking.

The total gross returns of all bark and timber sales amount to a present value of £26,668 19*s*., which includes all the thinnings ever obtained from the plantation and the clear-cutting of 46·7 acres above the 1,250 contour line. Clear-cutting was begun in 1903, and the return from the area thus felled amounts to £2,466 or £52 10*s*. per acre. This is undoubtedly a poor return for a larch wood at sixty-one years, but it must be borne in mind that this result was obtained from the highest and worst part of the wood, which contained, moreover, in that particular part a comparatively large admixture of spruce and Scotch pine, for which only 3*d*. per cubic foot was obtained against 10*d*. for larch. The crop standing on the remaining 151 acres has been put down at a value of £10,000, or an average of about £66 per acre. A detailed valuation was not made, but it is believed that the estimate is a conservative one, since the remainder of the wood lies for the most part below the 1,250 ft. contour.

Since the wood was opened to grazing in 1876, and a rental obtained thereby, the money so obtained has been included in the yields. The amount of all yields from grazing since 1876 is £1,456 13*s*. It is to be noted that only in the case of a larch wood could such substantial returns be obtained in this way. The shooting has been considered as of no value.

This, then, completes the list of expenses and returns, and the financial aspect has been summed up in Table VI.

The total gross returns have amounted to £38,125, and the expenses on the basis of acquiring the freehold to £14,662, and on the basis of renting the soil during the rotation to £17,670. There has, therefore, been a profit balance of £23,463 in the former case, and of £20,455 in the latter.

The gross revenue of £38,125 represents an equalised annual income of £1 3*s*. 5*d*. per acre,* while the profit of £23,463 represent 14*s*., and that of £20,455, 12*s*. 3*d*. per acre per year over and above 3 per cent. compound interest on all money invested.

If one takes the point of view that the land had already been acquired, and that any profit represents the rent obtainable under forestry, the expenses would be less by £1,013 13*s*.

* The amount of £1 per year for sixty-one years at 3 per cent. is £168·94504.

the present value of the purchase money, and the profit correspondingly greater, viz., £24,476 12*s.* in all. The annual rent obtained from the soil would then become 14*s.* 10*d.* per acre.

On the other hand, the maximum returns which would have been obtained under sheep-grazing amount to £4,021 13*s.*, which is equivalent to an annual rental of 2*s.* 5*d.* per acre. *There has therefore been obtained from this land 12s. 5d. per acre per year more than would have been obtained under sheep, or the rental from forestry is six times as great as from grazing.*

If the calculations be carried out with 5 per cent. as the rate of interest instead of 3 per cent., it will be found that the profit still amounts to over £5,000. It may now be asked whether a future crop of similar composition would be likely to pay so well as the past. Putting aside any question as to whether the soil will carry a second crop of larch as successfully, there are certain economic changes which will have to be faced. In the first place, the sale of bark is no longer profitable; that is to say, if the exact growth conditions of the past could be reproduced, the returns would suffer at the end of the rotation by £2,020 (calculated to the end of the rotation). Further, the price of planting would now be at least £5 per acre instead of £2, as in 1848. The extra £3 spent in this way would decrease the final profits by about £3,600. A small deduction would also have to be made on account of the relatively high prices (5*d.*–7*d.*) paid from 1873 to about 1887 for small spruce and Scotch pine. Similar timber would now bring not more than 3*d.* per cubic foot. The sum would only be small, however, since the quantity sold at this price did not amount to more than 10,000 cubic feet. Against these sources of loss may be placed the possibility of regenerating part of the area naturally at a lower cost than £5 per acre, and the probability of a rise in the price of timber.

A liberal estimate of the reduction then would be £6,000, which still leaves a profit of £17,500 if the land had to be purchased, or of £18,500 if it had already been acquired. The latter sum represents a soil rental of 11*s.* 1*d.* per acre, which is still *five times* the sum to be expected from sheep-grazing.

Reference to Table V. will show that for the first three periods of five years the plantation showed a net loss of 16*s.* 5*d.* (including planting), 1*s.* 3*d.*, and 3*d.* per acre respectively.

For the fourth period the profit was 1*s*. 6*d*. per acre; for the sixth, 10*s*. 5*d*.; the seventh, £1 12*s* 10*d*.; the eighth, £1 16*s*. 2*d*.; and the succeeding periods, 6*s*. 9*d*., 18*s*. 7*d*., £1 6*s*. 10*d*., and 18*s*.; while from the final fellings from 46·7 acres during the last ten years the profit has worked out at £1 6*s*. 3*d*. and £1 7*s*. 11*d*. per acre per year respectively. About the fifteenth year, then, the plantation began to pay its way, and as far as thinnings are concerned the best returns were obtained from the twenty-fifth to the thirty-fourth year. This is largely accounted for by the fact that at that time the sale of bark was very profitable.

The total volume of thinnings of larch timber (neglecting small stuff) works out at 172,900 cubic ft., or approximately 870 cubic ft. per acre; and of spruce, Scotch pine, and silver fir timber, 23,170 cubic ft., or 120 cubic ft. per acre.

The final fellings from 46·7 acres yielded 51,775 cubic ft. of larch, or 1,110 cubic ft. per acre, and 17,590 cubic ft. spruce, &c., or 380 cubic ft. per acre. As previously noted, this return was obtained from the poorer part of the wood.

Larch timber throughout has brought a good price, averaging about 10*d*., with a minimum of 8*d*. (1884), and a maximum of 1*s*. 1*d*. (1878) per cubic ft. The price obtained in 1909 was 10½*d*., with a slight upward tendency. Scotch fir and spruce brought 3*d*. per cubic ft.

For the purposes of comparison it may be useful to record the conditions under which these prices were obtained in 1909. The crop was felled by the buyer, who had to remove the timber within a year, and the price per cubic foot included the bark. The cutters receive 3*s*. per 100 cubic ft. for large larch, and 4*s*. to 4*s*. 6*d*. per 100 cubic ft. for small larch and spruce. The plantation is provided with a system of unmetalled roads which lead on to the main road from Keswick to Cockermouth over the Whinlatter Pass. They are for the most part badly graded.

The repair of the roads has to be executed by the timber merchants, and last year the sum of £28 was expended on this work. The timber is carted from the plantation to Cockermouth, where the larger material is sawn up and the smaller sent on to the mines at Whitehaven. The distances and conditions are such that each carter can take one load a day from the plantation to Cockermouth. The estimated cost

of cartage to Cockermouth is 2*d*., and to Whitehaven 4½*d*. per cubic foot. The carters receive a regular wage of 21*s*. per week.

All sizes of timber are marketable, and the tops find a local market in Keswick.

In connection with Coombe Plantation a number of interesting questions arise which cannot be satisfactorily settled owing to the lack of data relating to forestry in the district.

Underplanting.—One of these is the financial aspect of underplanting. It has already been pointed out that a substantial return has been obtained from grazing during the last thirty-three years in this plantation. From the purely forestry point of view it is in every way desirable to keep the ground covered with humus and to forgo grazing. In the case of a larch wood this means underplanting with a shade-bearing species as soon as the canopy overhead becomes so thin that grass springs up readily on the ground. From a financial point of view the matter stands as follows for this plantation:—The amount at 3 per cent. of all returns from grazing was, in 1909, £1,456 13*s*., or £7 7*s*. per acre. This would have been lost if the wood had been underplanted, and there would be a further charge of, say, £5 9*s*. (the amount of £2 for thirty-three years) for planting chargeable against the return. The value of the underwood at the time of felling (assumed to be 1909) would have to be £12 16*s*. to compensate for this. It would require 770 cubic ft. at 4*d*. per cubic foot.

In the absence of tables giving the returns from underplanting, it is difficult to give even an approximation to the probable returns, but there seems no reason to doubt that in the lower parts of the wood, where the shelter is good and Douglas fir could have been largely planted, the yield from a thirty-three-year-old underwood would exceed this volume. On the other hand, the growth of silver fir is so slow in the early stages (up to forty years) that it is doubtful whether the volume could be obtained. In any case, the underwood would not be ripe at the felling of the overwood, and its expectative value, if it could be allowed to grow on, would be considerably in excess of the required amount. There is also the improved rate of growth of the larch, owing to the better condition of the soil, to be kept in view. It is not

proposed to enter further into the question here, but merely to point out the need of collecting data and undertaking experiments on the subject.

The Value of Spruce at High Elevations.—It has already been noted that the plantation has not been a success in the highest parts, and it is interesting to attempt to fix the limit at which pure larch ceases to be profitable.

For the whole area the average volume per tree in 1909 may be put down at 10 cubic ft. If one assumes that the intermediate returns are proportional to the final volume per tree for each quality of locality,* one finds that the profit becomes *nil* if the average volume per tree falls to 4 cubic ft.—a volume attained at about 1,450 ft. This is without doubt the maximum elevation at which the wood has paid under these conditions, and a safer limit would be 1,400 ft., although the trees above this elevation have been of value in sheltering the rest of the crop. The question now arises whether the spruce or Scotch pine will pay to grow at this elevation, since the larch does not.

The height-growth of Scotch pine above 1,400 ft. is poor, and does not reach more than 30–35 ft. in sixty-one years. According to German yield tables,† this would correspond with a final yield at sixty years of about 1,600 cubic ft. true measurement, or not more than £40 per acre at 6*d*. per foot. There is no chance of such a crop proving a financial success under present conditions.

In the case of spruce the height-growth, in open groups, is considerably better, and varies from 48 ft. at 1,450 ft. to 35 ft. on the very exposed ridges at about 1,520 ft. An average height for the whole area above 1,400 ft. would be about 45 ft. This estimate makes some allowance for the fact that if grown in denser groups the trees in the higher parts would protect each other against wind to the benefit of the height-growth.

Under fairly dense canopy conditions it is held that the following returns per acre might be expected from spruce‡:—

* This assumption will give the intermediate returns too high in the case of the poorer qualities and therefore place the limit too high.

† Schlich's *Manual of Forestry*, Vol. III., p. 366.

‡ The volumes are taken from Schiffel's *Wuchsgesetze Normaler Fichtenbestände*, page 57, and were compiled for Austrian forests.

Age.	Thinnings. Cub. ft.	Price per cub. ft.	Value.	Value at end of 61 years' Rotation at 3 per cent. Compound Interest.
			£ s. d.	£ s. d.
35	140	3*d.*	1 15 0	3 11 0
40	224		2 16 0	4 18 0
45	266		3 6 6	5 0 0
50	308		3 17 0	5 0 0
55	322		4 0 6	4 10 0
60				
61	3150	4*d.*	52 10 0	52 10 0
			Total ...	75 9 0

According to this table, the value of all returns, calculated to the end of the rotation, would be £75 9*s.* If the expenses be taken at those which have already been incurred in Coombe Plantation on the basis of acquiring the freehold of the land, they will amount to £35 3*s.* 6*d.*, and the profit balance becomes £40 per acre, or 4*s.* 9*d.* per acre per year.

Allowing £5 for planting, £1 for purchase of land, and 3*s.* per acre per year for general expenses, the total amount of expenses at the end of the rotation would be £60 15*s.*, leaving a profit of £13 15*s.*, or 1*s.* 7*d.* per acre per year over and above 3 per cent. compound interest on all. Leaving out the question of the purchase of the land, a soil rental of 2*s.* 4*d.* would be obtained. The estimated *maximum* return is not greater than 2*s.* 5*d.*, and would probably not be more than 1*s.* 6*d.*

SUMMARY OF INTERMEDIATE YIELDS IN TIMBER AND BARK.

Details of the intermediate yields from 1859 to 1865 inclusive have not been kept. Only the actual money value has been recorded.

Year.	Produce.	Value.	
		£ s. d.	£ s. d.
1866	2,000 small larch at 6*s.* per 100	6 0 0	
	6 tons 18 cwt. 0 qrs. 14 lbs. peeled larch at rate of £10 per ton of bark	69 1 3	
	6 tons 18 cwt. 0 qrs. 14 lbs. larch bark at £3 10*s.* per ton	24 3 5	
			99 4 8

Year.	Produce.	Value. £	s.	d.	£	s.	d.
1867	1,200 small larch at 6*s.* per 100	3	12	0			
	14 poles at 6*d.* each		7	0			
	8 tons 8 cwt. larch bark at £3 10*s.* per ton	29	8	0			
	994 cub. ft. larch at 10*d.* per cub. ft. ...	41	8	4			
	8,500 yards peeled larch at 4*s.* 2*d.* per 100 yards	17	14	2	92	9	6
1868	200 yards larch thinnings at 5*s.* per 100 yards		10	0			
	12 tons 0 cwt. 2 qrs. larch bark at £4 ...	48	2	0			
	12 tons 0 cwt. 2 qrs. peeled larch at rate of £11 per ton of bark	132	5	6	180	17	6
1869	12 tons 1 cwt. 0 qrs. 14 lbs. larch bark at £4 10*s.* per ton	54	5	$0\frac{1}{2}$			
	12 tons 1 cwt. 0 qrs. 14 lbs. peeled larch at £10 10*s.* per ton of bark	126	11	$9\frac{1}{2}$	180	16	10
1870	8 tons 10 cwt. 1 qr. 14 lbs. larch bark at £4 10*s.* per ton	38	6	8			
	8 tons 10 cwt. 1 qr. 14 lbs. peeled larch at rate of £10 per ton of bark	85	3	9	123	10	5
1871	12 tons 14 cwt. larch bark at £4	50	16	0			
	3 tons 4 cwt. 2 qrs. (small) peeled larch for the sum of	26	0	0			
	9 tons 9 cwt. 2 qrs. peeled larch for the sum of	109	0	0	185	16	0
1872	12 spruce at 6*d.* each		6	0			
	15 tons 2 cwt. 3 qrs. peeled larch at rate of £11 10*s.* per ton of bark	174	1	$7\frac{1}{2}$			
	15 tons 2 cwt. 3 qrs. larch bark at £4 per ton	60	11	0			
	13 tons bobbin wood at 9*s.* per ton... ...	5	17	0	240	15	$7\frac{1}{2}$
1873	62 cub. ft. spruce at 7*d.*	1	16	2			
	$236\frac{1}{2}$ small spruce at 6*d.* each	5	18	3			
	13 tons 0 cwt. 1 qr. larch bark at £4 per ton	52	1	0			
	13 tons 0 cwt. 1 qr. peeled larch at rate of £13 per ton of bark	169	3	3	228	18	8
1874	40 cub. ft. larch at 1*s.* per cub. ft.... ...	2	0	0			
	96 cub. ft. spruce at 7*d.*	2	16	0			
	11 tons 7 cwt. 2 qrs. 14 lbs. larch bark at £4 10*s.* per ton	51	4	4			
	11 tons 7 cwt. 2 qrs. 14 lbs. peeled larch at rate of £13 per ton of bark	147	19	1	203	19	5
1875	470 small larch thinnings at 10*s.*	2	7	0			
	14 tons 19 cwt. 3 qrs. 14 lbs. larch bark at £4 15*s.* per ton	71	4	5			
	14 tons 19 cwt. 3 qrs. 14 lbs. peeled larch wood at rate of £12 10*s.* per ton of bark	187	8	5	260	19	10
1876	381 cub. ft. spruce and Scotch pine at 7*d.* per cub. ft.	11	2	3			
	$27\frac{1}{2}$ tons of bobbin wood at 11*s.* per ton ...	15	2	6			
	32 tons 13 cwt. 2 qrs. 14 lbs. larch bark at £5 5*s.* per ton	171	11	6			
	32 tons 13 cwt. 2 qrs. 14 lbs. peeled larch at rate of £13 per ton of bark	424	17	$1\frac{1}{2}$	622	13	$4\frac{1}{2}$

Year.	Produce.	Value.	
		£ s. d.	£ s. d.
1877	2,045 small larch thinnings at 12s. per 100	12 5 5	
	100 ,, ,, at 13s. per 100	13 0	
	1,849 cub. ft. Scotch pine, spruce and fir at 7d.	53 18 7	
	28 tons 5 cwt. 3 qrs. 14 lbs. larch bark at £5 5s. per ton	148 10 10	
	28 tons 5 cwt. 3 qrs. 14 lbs peeled larch at rate of £13 per ton of bark	367 16 4½	
	2 cwt. 2 qrs. 14 lbs. oak bark at £7 7s. ...	19 3½	
	18 cub. ft. peeled oak at 9d.	13 6	
			584 17 0
1878	590 cub. ft. spruce and Scotch pine at 7d. per cub. ft.	17 4 2	
	300 small larch thinnings at 15s. per 100 ...	2 5 0	
	700 ,, ,, at 12s. per 100 ...	4 4 0	
	5 tons of bobbin wood at 11s. per ton ...	2 15 0	
	24 tons 16 cwt. 1 qr. 14 lbs. larch bark at £5 per ton	124 1 10½	
	24 tons 16 cwt. 1 qr. 14 lbs. peeled larch at rate of £12 10s. per ton of bark ...	310 4 8¼	
			460 14 8
1879	28 cub. ft. peeled oak at 8d. per cub. ft. ...	18 8	
	12 cub. ft. larch at 1s. per cub. ft.... ...	12 0	
	625 cub. ft. spruce and Scotch pine at 6d. per cub. ft.	15 12 6	
	800 small larch at 12s. per 100	4 16 0	
	100 ,, at 15s. per 100	15 0	
	60 ,, at 2d. each	10 0	
	23 tons 10 cwt. 3 qrs. larch bark at £4 per ton	94 3 0	
	23 tons 10 cwt. 3 qrs. peeled larch at rate of £11 per ton of bark	258 18 3	
	1½ tons bobbin wood at 10s. per ton ...	15 0	
	3 cwt. 3 qrs. 14 lbs. oak bark at £5 15s. per ton	1 2 3½	
			378 2 8½
1880	17½ cub. ft. larch at 1s. 1d. per cub. ft. ...	18 11½	
	27 cub. ft. spruce at 7d. per cub. ft. ...	15 9	
	740 cub. ft. ,, at 6½d. per cub. ft. ...	20 0 10	
	600 small larch thinnings at 12s. per 100 ...	3 12 0	
	23 tons 18 cwt. 3 qrs. larch bark at £4 per ton	95 15 0	
	23 tons 18 cwt. 3 qrs. peeled larch at rate of £11 10s. per ton of bark ...	275 5 7¼	
			396 8 2
1881	947 cub. ft. spruce and Scotch pine at 6d. per cub. ft.	23 13 6	
	275 small larch thinnings at 15s. per 100 ...	2 1 3	
	500 ,, ,, at 12s. per 100 ...	3 0 0	
	32½ cub. ft. peeled oak at 8d. per cub. ft....	1 1 8	
	5 cwt. 0 qrs. 14 lbs. oak bark at £5 10s. per ton	1 8 2	
	30 tons 0 cwt. 2 qrs. larch bark at £3 17s. 6d. per ton	116 6 11	
	30 tons 0 cwt. 2 qrs. peeled larch at rate of £12 per ton of bark	360 6 0	
			507 17 6
1882	1,098 cub. ft. spruce and Scotch pine and silver fir at 5d. per cub. ft.	22 17 6	
	22 tons 9 cwt. 0 qrs. 14 lbs. larch bark at £3 10s. per ton	78 11 11	
	22 tons 9 cwt. 0 qrs. 14 lbs. peeled larch at rate of £12 per ton of bark	269 9 6	
			370 18 11

Year.	Produce.	Value.	
		£ s. d.	£ s. d.
1883	148 cub. ft. spruce and Scotch pine at 5*d.*	3 1 8	
	20 tons 11 cwt. 2 qrs. larch bark at £3 10*s.* per ton of bark	72 0 3	
	20 tons 11 cwt. 2 qrs. peeled larch at rate of £12 per ton of bark	246 18 0	321 19 11
1884	23½ cub. ft. larch at 10*d.* per cub. ft. ...	19 7	
	12 tons 19 cwt. 0 qrs. 14 lbs. larch bark at £3 10 per ton	45 6 11	
	12 tons 19 cwt. 0 qrs. 14 lbs. peeled larch at rate of £9 per ton of bark	116 12 1½	162 18 7½
1885	*Nil*	—	—
1886	1,000 cub. ft. spruce at 3*d.* per cub. ft. ...	12 10 0	12 10 0
1887	99 cub. ft. Scotch pine at 3*d.*	1 4 9	1 4 9
1888	978 cub. ft. spruce and fir at 3½*d.* per cub. ft.	14 5 3	
	67 cub. ft. larch at 8½*d.* per cub. ft. ...	2 7 5½	
	5 tons 8 cwt. 2 qrs. larch bark at £3 10*s.* per ton	18 19 9	
	5 tons 8 cwt. 2 qrs. peeled larch at rate of £10 per ton of bark	54 5 0	89 17 5½
1889	150 small larch at 15*s.* per 100	1 2 6	
	20 tons 4 cwt. 1 qr. larch bark at £3 10*s.* per ton	70 14 10½	
	20 tons 4 cwt. 1 qr. peeled larch at rate of £10 10*s.* per ton of bark	212 4 7½	284 2 0
1890	35 cub. ft. spruce and Scotch pine at 4½*d.* per cub. ft.	13 1½	
	76 cub. ft. larch at 9½*d.* per cub. ft. ...	3 0 2	
	15 tons 3 cwt. 3 qrs. larch bark at £3 10*s.* per ton	53 3 1	
	15 tons 3 cwt. 3 qrs. peeled larch at rate of £10 5s. per ton of bark	155 13 5	212 9 9½
1891	905 cub. ft. spruce and Scotch pine at 4*d.* per cub. ft.	15 1 8	
	91 cub. ft. larch at 10*d.* per cub. ft. ...	3 15 10	
	22 tons 7 cwt. 2 qrs. larch bark at £3 10*s.* per ton	78 6 3	
	22 tons 7 cwt. 2 qrs. peeled larch at rate of £10 10*s.* per ton of bark	234 18 9	332 2 6
1892	20 tons 1 cwt. 3 qrs. larch bark at £3 10*s.* per ton	70 6 1½	
	20 tons 1 cwt. 3 qrs. peeled larch at rate of £10 10*s.* per ton of bark	210 18 4½	281 4 6
1893	225 cub. ft. spruce at 4*d.* per cub. ft. ...	3 15 0	
	19 tons 9 cwt. 2 qrs. 14 lbs. larch bark at £3 10*s.* per ton	68 3 8	
	19 tons 9 cwt. 2 qrs. 14 lbs. peeled larch at rate of £10 15*s.* per ton of bark ...	209 8 5½	281 7 1½
1894	667 cub. ft. spruce at 4*d.*	11 2 4	
	17 tons 14 cwt. 1 qr. 11 lbs. larch bark at £3 10*s.* per ton	62 0 2	
	17 tons 14 cwt. 1 qr. 11 lbs. peeled larch at rate of £10 15*s.* per ton of bark ...	190 9 6	263 12 0

Year.	Produce.	Value.					
		£	s.	d.	£	s.	d.
1895	400 cub. ft. larch at 9*d.* per cub. ft. ...	15	0	0			
	34 tons 5 cwt. 2 qrs. larch bark at £3 7*s.* 6*d.* per ton	115	13	6			
	34 tons 5 cwt. 2 qrs. peeled larch at rate of £10 15*s.* per ton of bark	368	9	1			
					499	2	7
1896	5,800 cub. ft. spruce at 3*d.* per cub. ft. ...	72	10	0			
	50 cub. ft. larch at 9*d.* per cub. ft.... ...	1	17	6			
	24 tons 9 cwt. larch bark at £3 5*s.* per ton	79	9	3			
	24 tons 9 cwt. peeled larch at rate of £10 10*s.* per ton of bark	256	14	6			
					410	11	3
1897	22 tons 5 cwt. 2 qrs. larch bark at £3 5*s.* per ton	72	7	10½			
	22 tons 5 cwt. 2 qrs. peeled larch at rate of £10 per ton of bark	222	15	0			
					295	2	10
1898	28 tons larch bark at £3 5*s.* per ton ...	91	0	0			
	28 tons peeled larch at rate of £10 5*s.* per ton of bark	287	0	0			
					378	0	0
1899	83 cub. ft. spruce at 3*d.*	1	0	9			
	20 tons 8 cwt. 2 qrs. 16 lbs. larch bark at £3 per ton	62	16	0			
	20 tons 8 cwt. 2 qrs. 16 lbs. peeled larch at rate of £10 5*s.* per ton of bark.	214	10	2			
					278	6	11
1900	457 cub. ft. spruce at 5*a.* per cub. ft. ...	9	10	5			
	1,064 cub. ft. ,, at 4*d.* per cub. ft. ...	17	14	8			
	13 tons larch bark at £2 15*s.* per ton ...	35	15	0			
	13 tons peeled larch at rate of £10 10*s.* per ton of bark	136	10	0			
					199	10	1
1901	173 cub. ft. larch at 1*s.* per cub. ft. ...	8	13	0			
					8	13	0
1902	3,936 cub. ft. spruce and Scotch pine at 4*d.*	65	12	0			
	6,484 cub. ft. larch at 1*s.* per cub. ft. ...	324	4	0			
					389	16	0
1903	1,349 cub. ft. spruce at 3*d.* per cub. ft. ...	16	17	3			
	6,179 cub. ft. larch at 11*d.* per cub. ft. ...	283	4	1			
	19 tons 1 cwt. 2 qrs. larch bark at £2 15s. per ton	52	9	6			
	19 tons 1 cwt. 2 qrs. peeled larch at rate of £10 10*s.* per ton of bark	200	0	0			
					552	10	10
1904	3,848 cub. ft. spruce and Scotch pine at 3*d.* per cub. ft.	48	2	0			
	427 cub. ft. larch at 11*d.* per cub. ft. ...	19	11	5			
	17 tons 19 cwt. larch bark at £2 15s. per ton	49	7	3			
	4,963 cub. ft. larch timber by tender ...	195	0	0			
	Firewood		6	0			
					312	6	8
1905	4,008 cub. ft. spruce and Scotch pine at 3*d.* per cub. ft.	50	2	0			
					50	2	0
1906	4,765 cub. ft. larch at 10*d.* per cub. ft. ...	198	10	10			
	17 tons 16 cwt. larch bark at £2 5*s.* per ton	40	1	6			
					238	12	4
1907	12,017 cub. ft. larch at 9½*d.* per cub. ft. ...	475	13	5			
					475	13	5
1908	13,316 cub. ft. larch at 10*d.* per cub. ft. ...	554	16	8			
	3,574 cub. ft. spruce / 636 cub. ft. Scotch pine / 282 cub. ft. silver fir — at 3*d.* per cub. ft.	56	3	3			
					610	19	11
1909	16,285 cub. ft. larch by tender (10½*d.* per ft.)	712	10	0			
	5,240 cub. ft. spruce at 3*d.* per cub. ft. ...	65	10	0			
					778	0	0

Table IV.—Statement Showing the Expenses and Receipts in each Year from 1848 to 1909, with the Sums to which they would Amount in 1909 at 3 Per Cent. Compound Interest.

Year.	Expenses. Cost of land, planting and rent. Value in year incurred.	Expenses. Cost of land, planting and rent. Amount in 1909 at 3 per cent.	Expenses. Superintendence and expenses. Value in year incurred.	Expenses. Superintendence and expenses. Amount in 1909 at 3 per cent.	Returns. Timber yield (including bark). Value in year obtained.	Returns. Timber yield (including bark). Amount in 1909 at 3 per cent.	Returns. Grazing. Value in year obtained.	Returns. Grazing. Amount in 1909 at 3 per cent.	Remarks.
	£ s. d.	£ s. d.	£ s. a.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	
1848	200 0 0 565 10 0 15 0 0	1,213 13 0 3,431 13 0 91 1 0	10 0 0	60 14 0	—	—	—	—	The value of the land is put at £200; planting, &c., £565 10s. Rents, £15, are put in the same column to save space.
1849	15 0 0	88 7 0	10 0 0	58 18 0					
1850	15 0 0	85 16 0	5 0 0	28 12 0					
1851	15 0 0	83 6 0	12 0 0	66 13 0					
1852	15 0 0	80 17 0	12 0 0	64 14 0					
1853	15 0 0	78 10 0	12 0 0	62 16 0					
1854	15 0 0	76 5 0	12 0 0	61 0 0					
1855	15 0 0	74 0 0	12 0 0	59 4 0					
1856	15 0 0	71 17 0	15 0 0	71 17 0	5 11 6	26 14 0			
1857	15 0 0	69 15 0	20 0 0	93 0 0	2 12 6	12 4 0	—	—	Some young plants removed from the plantation and sold in these years.
1858	20 0 0	90 6 0	35 0 0	158 1 0	1 8 6	6 9 0			
1859	20 0 0	87 14 0	45 0 0	197 6 0	9 8 0	41 4 0			
1860	20 0 0	85 3 0	60 0 0	255 7 0	35 12 0	151 10 0			
1861	20 0 0	82 13 0	90 0 0	371 18 0	111 11 6	461 1 0			
1862	20 0 0	80 5 0	100 0 0	401 4 0	159 11 0	640 2 0	—	—	Details of sales not available.
1863	20 0 0	77 18 0	95 0 0	370 1 0	107 12 6	419 4 0			
1864	20 0 0	75 13 0	58 0 0	219 7 0	49 14 1	187 19 0			
1865	20 0 0	73 9 0	82 0 0	301 1 0	105 3 1	386 1 0			
1866	20 0 0	71 6 0	61 0 0	217 9 0	99 4 8	353 14 0			
1867	20 0 0	69 4 0	83 0 0	287 5 0	92 9 6	320 1 0			
1868	40 0 0	134 8 0	88 0 0	295 13 0	180 17 6	607 14 0			
1869	40 0 0	13[illegible] 10 0	76 18 0	250 17 0	180 16 10	589 18 0			
1870	40 0 0	126 14 0	74 0 6	234 9 0	123 10 5	391 4 0			
[illegible]	[illegible]	122 0 0	73 18 1	227 5 0	185 16 0	571 6 0			
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			

1875	40 0 0	109 5 0	[illegible]	[illegible] 12 0	622 13 4	1,051 10 0	40 0 0	106 2 0	Plantation opened to grazing.
1877	40 0 0	103 0 0	115 5 1	299 7 0	584 17 0	1,506 1 0	40 0 0	103 0 0	
1878	40 0 0	100 0 0	104 17 11	262 5 0	460 14 8	1,151 17 0	40 0 0	100 0 0	
1879	40 0 0	97 2 0	104 12 1	253 18 0	378 2 8	917 17 0	40 0 0	97 2 0	
1880	40 0 0	94 5 0	105 15 9	249 6 0	396 8 2	934 3 0	40 0 0	94 5 0	
1881	40 0 0	91 10 0	108 10 0	248 5 0	507 17 6	1,162 0 0	40 0 0	91 10 0	
1882	40 0 0	88 17 0	93 5 0	207 3 0	370 18 11	824 0 0	40 0 0	88 17 0	
1883	20 0 0	43 3 0	66 8 0	143 4 0	321 19 11	694 8 0	20 0 0	43 3 0	
1884	20 0 0	41 18 0	46 12 0	97 11 0	162 18 7	341 3 0	20 0 0	41 18 0	
1885	20 0 0	40 13 0	50 4 0	102 1 0	—	—	20 0 0	40 13 0	
1886	20 0 0	39 9 0	47 6 0	93 7 0	12 10 0	24 13 0	20 0 0	39 9 0	
1887	20 0 0	38 6 0	46 0 0	88 3 0	1 4 9	2 7 0	20 0 0	38 6 0	
1888	20 0 0	37 4 0	55 6 6	102 18 0	89 17 5	167 4 0	20 0 0	37 4 0	
1889	20 0 0	36 2 0	39 10 6	71 8 0	284 2 0	513 2 0	20 0 0	36 2 0	
1890	20 0 0	35 1 0	86 0 2	150 16 0	212 9 9	372 12 0	20 0 0	35 1 0	
1891	20 0 0	34 1 0	96 14 0	164 13 0	332 2 6	565 8 0	20 0 0	34 1 0	
1892	20 0 0	33 1 0	95 3 7	157 6 0	281 4 6	464 16 0	20 0 0	33 1 0	
1893	20 0 0	32 2 0	88 1 0	141 6 0	281 7 1	451 10 0	20 0 0	32 2 0	
1894	20 0 0	31 3 0	79 13 0	124 2 0	263 12 0	410 14 0	20 0 0	31 3 0	Heavy clearing after
1895	20 0 0	30 5 0	130 7 2	197 4 0	499 2 7	755 0 0	20 0 0	30 5 0	storm of Dec. 22, 1894.
1896	20 0 0	29 7 0	111 9 6	163 14 0	410 11 3	602 18 0	20 0 0	29 7 0	
1897	20 0 0	28 10 0	103 3 4	147 2 0	295 2 10	420 16 0	20 0 0	28 10 0	
1898	20 0 0	27 14 0	121 19 9	168 18 0	378 0 0	523 5 0	20 0 0	27 14 0	
1899	20 0 0	26 18 0	109 3 10	146 15 0	278 6 11	374 2 0	20 0 0	26 18 0	
1900	20 0 0	26 2 0	98 19 2	129 2 0	199 10 1	260 6 0	20 0 0	26 2 0	
1901	20 0 0	25 7 0	58 10 0	74 2 0	8 13 0	10 19 0	20 0 0	25 7 0	
1902	20 0 0	24 12 0	64 10 3	79 7 0	389 16 0	479 8 0	20 0 0	24 12 0	A. R. P.
1903	15 0 0	17 18 0	107 8 9	128 6 0	552 10 10	659 15 0	15 0 0	17 18 0	1903–4, clear cut, 12 3 1
1904	15 0 0	17 8 0	106 3 2	123 1 0	312 6 8	462 2 0	15 0 0	17 8 0	1905–6 ,, 5 3 0
1905	15 0 0	16 18 0	54 6 6	61 3 0	50 2 0	56 8 0	15 0 0	16 18 0	1906–7 ... ... 6 1 19
1906	15 0 0	16 8 0	105 7 6	115 3 0	238 12 4	260 15 0	15 0 0	16 8 0	1907–8 ... ... 10 2 0
1907	15 0 0	15 18 0	12 10 0	13 5 0	475 13 5	504 13 0	15 0 0	15 18 0	1908–9 ... ... 11 1 15
1908	15 0 0	15 9 0	14 9 0	14 18 0	610 19 11	629 7 0	15 0 0	15 9 0	
1909	15 0 0	15 0 0	15 0 0	15 0 0	779 0 0	779 0 0	15 0 0	15 0 0	Total 46 2 35
	—	4,021 13 0	—	10,087 2 0	—	26,668 19 0	—	1,456 13 0	

Period.	Age of plantation.	Thinnings.							
		Small stuff.				Timber.			
		Larch.		Spruce.		Larch.		Spruce.	
		Number.	Value.	Numbr.	Value.	Cubic feet.	Value.	Cubic feet.	Va[illegible]
			£ s. d.		£ s. d.		£ s. d.		£ [illegible]
1848 — 1852	0 — 4	—	—	—	—	—	—	—	—
1853 — 1857	5 — 9	—	—	—	—	—	—	—	
1858 — 1862	10 — 14	Details of sales not available until 1866.							
1863 — 1867	15 — 19								
1868 — 1872	20 — 24	200 yards at 5*s.* per 100 yards	0 10 0	12 at 6*d.* each	0 6 0	16,017 ft. 9*d.* to 10½*d.* per ft.	653 2 8	—	
1873 — 1877	25 — 29	2615 10*s.* to 13*s.* per 100	15 5 5	236½ 6*d.* each	5 18 3	26,636 ft. 11¼*d.* to 1*s.*	1,299 4 3	2,388 ft. 7*d.*	[illegible]
1878 — 1882	30 — 34	3335 12*s.* to 16*s.* 8*d.* per 100	21 3 3	—	—	33,095 10*d.* to 1*s.* 1d.	1,475 15 0	4,027 ft. 5*d.* to 7*d.*	[illegible]
1883 — 1887	35 — 39	—	—	—	—	8,908 8d to 11*d.*	364 9 9	1,247 3*d.* to 5*d.*	[illegible]
1888 — 1892	40 — 44	150 15*s.* per 100	1 2 6	—	—	22,305 8½*d.* to 10d.	877 3 7	1,918 3½*d.* to 4½*d.*	[illegible]
1893 — 1897	45 — 49	—	—	—	—	31,773 9*d.* to 10*d.*	1,264 14 0	6,692 3*d.* to 4*d.*	[illegible]
1898 — 1902	50 — 54	—	—	—	—	22,936 9½*d* to 1*s.*	970 17 2	5,544 3*d.* to 5*d.*	[illegible]
1903 — 1907	55 — 59	Final fellings from 46·7 acres.				33,406 9½*d.* to 11*d.*	1,371 19 9	9,205 3*d.*	[illegible]
1908 — 1909	60 — 61					29,601 10*d.* to 10½*d.*	1,267 6 8	9,732 3*d.*	[illegible]

XPENSES IN FIVE-YEARLY PERIODS.

Larch Bark. Weight.	Larch Bark. Gross value.	Larch Bark. Approximate net value.	Miscellaneous returns.	Planting, superintendence, and general expenses.	Rates.	Net gain (+) or Net loss (−). For the whole wood.	Net gain (+) or Net loss (−). Per acre per year.
	£ s. d.	£ s.			£ s. d.	£ s. d.	£ s. d.
—	—	—	—	Planting, £565 10s. Land, £200. Superintendence and general expenses, £49	—	−814 10 0	−0 16 5
—	—	—	Sale of Plants £8 4s.	£ s. d. 71 0 0	—	−62 16 0	−0 1 3
Details of Sales not available until 1866.				330 0 0	—	−12 9 0	−0 0 3
				379 0 0	—	+75 3 10	+0 1 6
) tons 8 cwt. 3 qrs. 4 to £4 10s. per ton	252 0 8	101 0	13 tons bobbin wood at 9s. = £5 17s.	395 8 5	—	+516 7 11	+0 10 5
100 tons cwt. 1 qr. 4 to £5 5s.	494 12 1	244 0	27½ tons bobbin wood at 11s. a ton; 2 cwt. 2 qr. 14 lb. oak bark at £7 7s. per ton; 18 cb ft. oak at 9d. = £16 15 3	369 6 11	5 13 4	+1,626 8 0	+1 12 10
124 tons cwt. 2 qr. 3 10s. to 5 per ton	508 18 9	197 0	6½ tons bobbin wood, 60 cb. ft. oak, 9 cwt. oak bark = £8 0s. 8d.	517 0 9	14 3 4	+1,782 17 10	+1 16 2
3 ons 10 cwt. 2 rs. 14 lbs. 3 10s. per ton	117 7 2	33 10	—	256 10 0	8 6 8	+333 16 7	+0 6 9
8 ons 5 cwt. 3 qrs. 3 10s. per ton	291 10 1	83 0	—	372 14 9	8 6 8	+918 14 9	+0 18 7
1 tons 4 cwt. 3 5s. to 3 10s. per ton	397 14 5	102 10	—	512 14 0	8 6 8	+1,328 15 1	+1 6 10
6 ons 8 cwt. 2 s. 16 lbs. 3 5s. to 15s. per ton	189 11 0	36 0	—	453 3 0	8 6 8	+892 16 4	+0 18 0
4 tons 16 wt. 2 qrs. 15s. to £ 5s. per ton	141 18 3	5 0	Firewood 6s.	385 15 11	17 10 0	+1,300 19 4	+1 6 3
—	—	—	—	29 9 0	7 0 0	+1,382 10 11	+1 7 11

TABLE VI

SUMMARY.

Amount in 1909 at 3% Compound Interest.

Returns.				Expenses. (a) Acquiring freehold of land.				Expenses. (b) Renting throughout rotation.			
	£	s.	d.		£	s.	d.		£	s.	d.
Timber and bark sales	26,668	19	0	Cost of land...	1,013	13	0	Rent of land	4,021	13	0
Grazing	1,456	13	0	,, planting, roads, drains, and fencing	3,431	13	0	Planting, roads, drains and fences	3,431	13	0
Value of standing crop	10,000	0	0	,, superintendence and expenses	10,087	2	0	Superintendence and expenses ...	10,087	2	0
				Rates and taxes	130	5	0	Rates and taxes	130	5	0
				Balance	23,462	19	0	Balance	20,454	19	0
Total	38,125	12	0	Total	38,125	12	0	Total	38,125	12	0

Estimated return under sheep not greater than rent given above, *i.e.*, £4,021 13*s.* 0*d.*

The shooting has been considered of no value.

CAMEMBERT AND OTHER SOFT CHEESES.

JOHN BENSON.

Hard or pressed cheeses have for many generations been manufactured in this country, and are well known everywhere, but until recent years little has been heard concerning another type of cheese, properly called *soft cheese*.

No country has been so successful in the manufacture of soft cheeses as France, whence we obtain nearly all the delicate and refined varieties. To a certain extent the climate may be responsible for the great success of French cheese-makers, but given favourable conditions as to climate and locality, such as prevail in the south and south-western districts of England, and the presence in the dairies of the necessary moulds and bacteria, there is no reason why really good soft cheeses should not be made in Great Britain. It has, in fact, been proved that cheeses can be made equal in all respects to the best French produce, especially in the south Midlands and the south and west of England, which possess a moderately equable climate very similar to the soft cheese-making districts of France.

The production of soft cheese is especially to be recommended to small farmers and to others who have small quantities of milk available, particularly when they are situated near populous centres or watering-places in the southern parts of England. The demand for soft cheese in the north Midlands or northern districts of England is not great.

The chief obstacle in the way of the successful development of the soft cheese industry lies in the difficulty of controlling the ripening so as to make the produce uniform. Even in the localities where these cheeses are made in France the quality may vary greatly; hence it is necessary for the prospective cheese-maker to acquaint himself with the conditions desirable, the various rooms required, and the temperature at which each should be maintained.

In general, three rooms are necessary: (1) a *making room*, in which the milk is coagulated, drained, and formed into cheeses; (2) a *drying room*, where the cheeses undergo the

first stages of ripening; and (3) a *ripening room* (or cellar), kept at a low temperature, in which the cheeses undergo the final process of ripening and refinement. The temperature, moistness of the atmosphere, and ventilation differ in each of these rooms, and unless the maker is fully acquainted with the conditions which should prevail in each, his attempts at manufacture will almost certainly end in failure.

Fortunately, however, it is not difficult to adapt to the purpose of soft cheese making the buildings usually found in small homesteads. The *making room* need not be large, but should be provided with means for artificial heating so that the apartment can be kept at a constant temperature. The *drying room* should be in such a position and so constructed that the temperature and ventilation can be regulated at will. Thorough ventilation with means of controlling it is absolutely necessary in the drying room. The final *ripening room* should be moist, and not subject to any great variations in temperature.

The refined soft cheeses most popular are the Camembert and Brie.* The Pont l'Evêque cheese is also well known, and though it is usually considered a soft cheese, the mode of manufacture and ripening differs somewhat from that of the true type of soft cheese, the ripening not being due to mould growth, but depending largely upon the enzymes of rennet, a comparatively large quantity of which is used in the coagulation of the milk.

It will be wise on the part of the maker to specialise in one variety of cheese only, as each variety described below requires a different degree of temperature, moisture, &c., in the different stages of manufacture.

As generally understood, soft cheeses are small, non-pressed, and quickly ripened, and are frequently so soft as to be spread upon bread like butter. Usually they are made from perfectly sweet milk, and development of acidity takes place in the milk after the rennet has been added, or in the curd whilst draining and before the application of salt. On the other hand, with the hard or pressed type of cheese the milk is partially soured or ripened before the addition of

* A description of Brie, Pont l'Evêque and other soft cheeses will appear in next month's issue.

rennet, and all the acid necessary for securing the correct type of cheese is developed before the curd is salted or placed in the hoops or forms in which they are pressed.

Soft cheeses—though each variety may be made in a special manner—all agree in one particular, namely, that the whey is never fully drained from them. The coagulated milk is usually ladled into forms or metal hoops, and the cheeses allowed to drain naturally. They are not subjected to heat or pressure, and consequently contain a much larger amount of water at the beginning of the ripening stage than do hard cheeses. As a consequence of this soft and moist condition they afford favourable conditions for the growth of various micro-organisms and fungi, and enzyme action occurs more readily than in the pressed or hard varieties of cheese.

The action of these groups of fermentation agents ripens the cheeses rapidly and develops high flavours, as in the Camembert, Brie, and other varieties. Certain moulds which form readily upon the surface of these cheeses play an all-important part in the ripening process.

These moulds are aerobic, and the ripening propagates itself from the surface to the interior. The breaking-down or ripening of the curd is due in most cases to the production of unorganised ferments or enzymes, but the flavour, texture, and appearance of the curd are different for different varieties of cheese, depending largely upon the methods of treating the curd, the quality of the milk, and the conditions in the ripening rooms.

From the foregoing remarks it will be gathered that the ripening of soft cheeses is due to the presence of certain moulds and bacteria, and it is a fact that the maker never produces a Camembert or Brie cheese of correct texture or flavour unless he is able to grow upon the surface certain types of moulds. In the ripening of the cheeses the mycelium (or "roots") of these moulds penetrates to a short distance into the surface of the cheese and secretes enzymes, proteid digestive materials which gradually bring about changes of a digestive nature in the raw curd, this action being equivalent to ripening. In the true type of ripened soft cheese, such as Camembert, the ripening proceeds from

the surface towards the centre. Beginning at the outside there appears a change of the hard raw curd into a softer buttery material, and if the cheeses are properly made this slowly extends to the centre, and in from three to five weeks the ripening process will be complete.

It is necessary for the luxuriant propagation of the desired moulds that the curd should at the outset be highly acid. Unless the curd is sufficiently acid or sour at the time of salting, the mould will never afterwards grow properly, but if the making room is kept at a sufficiently high temperature during the draining process, the cheeses are certain to attain to this condition before the application of salt, which to a great extent stops the development of acidity. The acidity should, however, be allowed to develop naturally. If starters of lactic-acid bacteria are used in soft-cheese making—as in cheddar-making—the development of acidity will be too rapid during the first stages and the curd will drain quickly, becoming hard and dry, and will not contain sufficient moisture for the growth of the desired moulds. The only ripening material admissible in the manufacture of soft cheeses is a mixture of a little of the ripe cheese—which contains the spores of the moulds or fungi—with water or sweet whey, and this is introduced into the milk before renneting. (The preparation of this form of starter or inoculating material is dealt with on p. 376.)

METHOD OF MAKING CAMEMBERT CHEESE.

The Camembert is a French variety of cheese, and in France is usually made from whole milk of a quality similar to that given by Shorthorns; often, however, separated or perfectly sweet skimmed milk is mixed with the new in the proportion of 1 to 5. This cheese is usually made from September to May. During the summer months its manufacture should not be attempted, as the cheese does not then ripen properly. In summer the Camembert gets too soft, and has an offensive smell, and the demand in summer is for a soft cheese of a fresh or unripened type. The cheeses are small—about $4\frac{1}{2}$ ins. wide and $1\frac{1}{4}$ ins. thick—and weigh from 10 to 13 oz. About $5\frac{1}{2}$ gallons of mixed new and

skim milk are required for each dozen cheeses. Camemberts are usually sold retail at *7d.* or *8d.* each, and the maker realises a really good price for the milk used in their manufacture.

The milk is received uncooled direct from the cow. Milk that has been cooled does not make good Camembert cheeses. If separated milk is added, it should be perfectly sweet and fresh and free from froth. The milk is strained into wooden tubs provided with close-fitting lids; tubs of a correct size hold six gallons each. Metal vessels should not be used, or the outside portion of the curd will get chilled, and this chilled and soft curd causes irregularity in the cheeses afterwards. A six-gallon setting tub will hold sufficient milk to make two dozen cheeses if the two-curd system, which is the best, be employed. The cheeses are sometimes finished at one operation, but the two-curd system is preferable—half of the curd being filled into the moulds in the evening, and the other half the following morning.*

The milk is usually renneted at a temperature of from 80° to 82° F., and ½ c.c. of rennet of a standard brand per gallon of milk is added so as to produce perfect coagulation in from 2 to 2½ hours. The rennet should be mixed with six times its volume of water and be thoroughly stirred into the milk.

The milk is stirred gently and carefully at first to prevent the rising of the cream. If the cream be allowed to rise during coagulation it will show in streaks in the body

* The two-curd system is considered preferable for the following reasons:—If made of two curds the cheeses drain better, and there is less loss through oozing of the curd from the forms or hoops. There is also no need to wait for the curd to settle and chill before the hoop is completely filled. If the moulds are altogether filled at one operation the lower portion of the curd is subject to too much pressure, and irregularity in the moisture content of the cheese will ensue. Another most important point in favour of the two-curd system lies in the application of salt. It is necessary to salt these cheeses twice with an interval of six or eight hours between each salting. If the cheeses are made in two operations the lower or older portion is turned up and salted first, and by the time the salt has dissolved the newer surface will be ready to be salted and it will then be almost identical as regards age, acidity, etc., with the first-made curd, whereas if the cheese has been made of one curd only and an interval allowed between the salting of the two surfaces—which, if the salting is to be properly accomplished, is absolutely necessary—then it follows that the top and bottom will differ in acidity and one side of the cheese will ripen differently from the other. In cheeses made of one curd only it is often found that the last salted side fails to mould and ripen at all, because it has been too sour and draining has proceeded too far.

of the cheese, and any of the creamy substance appearing on the surface of the cheese will fail to mould satisfactorily.

To introduce the proper moulds and ferments into the cheeses, and into the dairy where soft cheeses have not previously been made, it is advisable to inoculate the milk with what is termed a "starter," which is introduced before renneting.*

The curd when ready is ladled out into forms or hoops of metal $4\frac{1}{2}$ ins. in diameter and $4\frac{1}{2}$ ins. high. These hoops rest upon straw mats placed on an inclined and grooved draining-table, made in such a form that the whey readily drains away.

The ladle used should have a sharp cutting edge and go easily into the hoops. Before ladling out the curd it is well to pour a little warm water into each hoop, as this produces a better face upon the cheeses. The cheeses are then left overnight, twenty-four of the half-cheeses having been made from $5\frac{1}{2}$ gallons of milk used. By morning they will have drained to about two-thirds of their original dimensions. In the morning a similar quantity of milk is taken and treated as described, but before ladling out the morning's curd the surface of the first portion of the cheese should be carefully broken up with a wooden spatula to admit of the two curds joining properly; unless this be done, the cheese is liable to break in half. In ladling out the morning's or second half of the curd, it is important that the last slices be placed upon the surface of the cheese in an unbroken condition; to ensure this a little curd with which to finish the cheeses should at the outset be placed on one side.

The cheeses are now left to drain in a temperature of not less than 65° F., and when the two curds are approximately thirty-six and twenty-four hours old they should be more

* This culture of the desired ferments, etc., is made as follows:—Take a small portion of curd, say $\frac{1}{2}$ oz., from just below the crust of a really good half-ripe Camembert. Macerate this piece of curd and add it to half a pint of distilled water or sweet whey at a temperature of about 80° F. Stir occasionally until the curd has thoroughly dissolved and then strain into the milk from which the cheese will be made. Stir the milk for a while so that the ferments get properly distributed before the addition of rennet. This inoculation of the milk should be repeated for a few days or until the cheese rooms and utensils get thoroughly permeated with the ripening ferments. Afterwards if conditions are favourable the mould will make its appearance upon the cheeses naturally.

than half-way down the hoop and firm enough to admit of turning. The turning of the cheeses is rather a delicate operation, and requires much practice before it can be skilfully performed. The maker, deftly putting his left hand under the cheese without removing the hoop, inverts the whole, steadying the cheese meanwhile with his right hand and placing it face downwards upon a fresh straw mat. The upturned surface of the cheese should present an unbroken grooved appearance due to the straw upon which it has been resting. Sometimes the cheeses settle too rapidly. This is due to the milk being out of condition—a little sour, perhaps, or the making room may have been kept at too high a temperature. At other times the cheeses fail to drain or settle sufficiently; when this is the case the temperature has usually been too low at renneting, or the temperature of the room may have been too low. Cheeses which drain slowly are usually fermented and spongy, the excess of moisture setting up abnormal fermentation. Such cheeses are never good. They are nearly always slimy on the outside, and a slimy cheese will never mould or ripen properly.

The salting of the cheese takes place when the curd has shrunk a little from the sides of the hoops, and the upper and older surface is salted first with fine dry salt spread evenly, about $\frac{1}{2}$ oz. being used for each cheese. After thus salting the upper face only, the cheeses are left for six to eight hours in the hoops, when the second salting takes place. The hoops are removed, the cheeses turned and held in the palm of the left hand, salt being applied to the new upper surface and to the sides, the latter being rubbed heavily with salt. The cheeses should then be placed on sparred shelves in the making room and turned twice daily. When they begin to show the growth of a fine white, rather pilose or hairy mould, evenly distributed, they are removed to the drying room. Up to this stage all the processes have been carried out in the making room.

The drying room is an apartment with preferably a northern aspect, and so constructed as regards ventilation that currents of air can be directed upon the cheeses in all

directions. Provision is made for artificial heating, and the slides and windows are so constructed that they can be opened and shut at will. The room should be kept at a temperature of from 54° to 56° F., and not be too dry. If the conditions are favourable the Camembert mould will grow rapidly, and in course of time blue tints will appear upon the extremities of the white mould, and the cheeses generally will assume a greyish-blue appearance. When this point is reached the cheeses must be removed to the cellar or cave. The object in bringing the cheeses into the first ripening or drying room is to get a fairly dry surface, and also to facilitate the development of the fungi which exercise such an important part in the ripening process.

During the time the cheeses are in the drying room a great deal of attention and observation is necessary on the part of the maker. If the moulds do not grow freely or the cheeses shrink, then the atmosphere is too dry. If, on the other hand, the cheeses get greasy or points of dark green or black appear, then the temperature is either too low or the atmosphere too damp. In the drying room the sparred shelves should run down the middle and not be placed against the wall, and the cheeses are first placed on the top shelves and gradually lowered as they ripen, and new cheeses are brought in.

At the stage when the cheeses are removed to the cellar or ripening room they should feel soft and springy to the touch. The atmosphere of the cellar should be fairly damp and still, and little ventilation is required. The temperature should be maintained at about 50° F., and the cheeses should be turned daily. The shelves upon which the cheeses rest are covered with wheat straw, which is occasionally changed.

On removing the cheeses to the lower temperature of the cellar the growth of the moulds is greatly reduced, and largely ceases. The outsides assume a reddish-brown appearance, and the cheeses get a little sticky and glairy on the surface. This is an indication that the cheeses are ripe and ready for sale, for at this stage certain compounds are formed which give characteristic flavours to this type of cheese. If kept too long they will rapidly deteriorate and liquefy, and become unpalatable.

The cheeses are usually packed in lots of six and wrapped in straw, or they may be placed in the familiar wooden chip boxes and sent to market when about three-fourths ripe.

The mould growth on Camembert cheese is of the greatest importance, and if the colour appears in any different sequence to that described, then the cheeses will be inferior.

At first the cheeses should be covered with a pure white rather pilose mould, forming a layer of about one-eighth of an inch thick over the whole surface of the cheese. With the ripening of the spores of the mould the colour gradually changes to greyish-blue. This change becomes complete in about three weeks from the time of making, and no further mould-growth seems to take place afterwards. Finally, the mould breaks down and the brown-reddish condition of the surface appears, and at this stage the cheeses are considered ripe. In a well-made cheese, cut through the middle when ripe, the softening of the curd will extend to the centre, whereas a cheese badly made will show a layer of hard sour curd in the centre, while the outside portions will be in an almost liquid state.

IMPROVEMENT OF CROPS BY SELECTION.

R. B. GREIG,

North of Scotland Agricultural College, Aberdeen.

AT Svalof, a small village in the south of Sweden, about an hour's railway journey from Malmö, is the headquarters of the "Swedish Society for the Improvement of Seeds," presided over by Dr. Nilsson. The success of Dr. Nilsson's method of producing improved races of farm crops is now well established, but the means by which this success has been attained are only vaguely known outside of biological laboratories, although the discoveries made at Svalof are likely to influence the practice of agriculture in every quarter of the globe. The following description, largely from notes taken on the spot during the summer of 1909, may help to dispel the fog which necessarily conceals the work of a foreign investigator, a knowledge of whose language is seldom included in the accomplishments of a botanist or agriculturist.

The work at Svalof is based on two discoveries, first, that among the farm crops there exists an indefinite number of elementary species which breed true; and secondly, that superior individuals among those species can be quickly recognised by certain morphological characters. The first discovery was almost an accident; the second was the result of painstaking and minute investigation, assisted by an elaborate system of record keeping.

The Swedish Society for the Improvement of Seeds was founded in 1886 by landowners interested in agriculture, its object being to produce by means of systematic selection new varieties of farm crops yielding returns both larger and of better quality. At first it was handicapped by inadequate funds and inferior buildings, but some years ago fine laboratories and other buildings were erected at a cost of 300,000 kroner, or upwards of £16,000, and the present income is 80,000 kroner, or between £4,000 and £5,000, made up as follows:—

	£
Government subsidy	2,200
Agricultural societies	1,100
The Swedish Seed Co.	275
Members of the Society	550
Sale of produce	275
	4,400

The staff consists of fifteen trained specialists, who divide the work in such a manner that the improvement of wheat is entrusted to one expert, the culture of clover to another, potatoes to a third, &c. The experimental plots number more than 4,000, and besides the headquarters at Svalof, there is a branch experiment station at Ultuna in Central Sweden, and at Lulea in Northern Sweden, while one or two smaller experiment centres in each of the provinces enable the staff to ascertain the agricultural value of their introductions under different conditions of soil and climate.

Group Selection a Failure.—When the work began in 1886 a method of selection was adopted based on elaborate weighings and measurings, for which ingenious and delicate instruments were invented or introduced. To take barley as an example of how group selection was carried out—a thousand grains known to be superior in composition were planted

Laboratories of the Swedish Society for the Improvement of Seeds at Svalof.

Experiment Grounds.

and grown under precisely similar conditions, all inferior plants were moved and the remaining individuals carefully examined during the winter, as to the plant as a whole, as to the head, and as to the grain. From the best were selected only those which produced three stems; from those only the primary ears were taken, and all the ears were weighed on a delicate balance. All under the average were discarded. Of the residue, those with the densest ears were retained, and from this final residuum only the grains from the middle of the ear were preserved for sowing. In the following year the same strict selection was repeated. At the end of five years the result was nothing but disappointment. Chevalier barley, for example, was only $1\frac{1}{2}$ per cent. denser than at the beginning. What was the reason? In nearly all cases the plots had been sown with grain which was derived from a group of ears similar in appearance, and, therefore, supposed to be of the same type. It was noticed that the progeny of these was never homogeneous, but the plants varied in leafage, in length of straw, in maturity, &c.

The Single Ear the Unit of Selection.—In 1890 or 1891, however, a few small plots among more than a thousand were found to be of the same type; each plant was precisely similar to its neighbour on the plot. Reference to the elaborate records showed that the homogeneous plots were the progeny of a single head or panicle, and it was therefore concluded that cultures can only be pure when started from a single ear. In the following year over 1,000 plots were sown with seed from single ears, and the result was conclusive. With very rare exceptions all the offspring of a single plant were exactly alike. Of 422 plots of oats, 397 were uniform, and only 25 were heterogeneous, and those exceptions might have been hybrids or imperfectly pollinated. Thus was the principle firmly established that the starting point or unit of selection is the single ear or head. Further investigation brought out the fact that in an ordinary field of wheat, oats, or barley, were dozens of different types, most of which would breed true. The next step was to discover the superior types or those specially adapted for special conditions.

The Association of Characters.—The discovery of the

superior types by the old method would necessitate, first, selection in the field and then selection in the plot, *i.e.*, if 1,000 ears had been planted in 1,000 plots or rows, the best must be selected from these by weighing and measuring the produce of each plot, and from the residue the best again selected. This is incredibly laborious, and entails the growth and cultivation over many years of many hundreds or thousands of individuals which must ultimately be discarded. If a superior oat plant, for example, could be isolated at the first selection, and at once put into competition with the existing strains of the type which it is intended to displace, much intermediate work could be saved. This is exactly what has become possible. It has been demonstrated that certain characters of apparently negligible importance are actually trustworthy indicators of the productive powers of an individual and of its quality. An example of this law of correlation or association of characters from each of the common cereals will suffice. Oats may be found with panicles of different types, and many of the individuals are pure. A plant which has the main branches of the whorls longer than the main stem is prolific; further, in this prolific group is a sub-race in which the larger grains are above the middle of the panicle, and this sub-race is the best; and in this sub-race is a strain in which the colour of the grain is an additional indication of productiveness. With this knowledge, the original selection of types from the field is easy. In wheat the number of kernels in each spikelet, the density of the ear, the shape and venation of the scales, and even the hairiness of the scales, are correlated with practical qualities. A concrete case taken from the record of barley improvement will best illustrate this shorter method of selection.

A barley was wanted in Sweden with the brewing quality of Chevalier, but without its fatal weakness of straw. To breed a strong-strawed Chevalier had proved impossible, but it had been found that the hairs on the base of the scales of barley were correlated with the composition of the kernel, and that short, stiff, woolly hairs were marks of a good brewing barley. A stiff-strawed but coarse barley called Imperial was carefully searched for ears showing this character of hairs,

and about sixty plants were discovered with the indicating hairiness. Of those sixty about thirty turned out after plot trial and analysis to be carrying the correlated characters. Field trials of the second generation produced eight good brewing barleys from the thirty, and further trials extracted from the eight the best—namely, Primus. This Primus is a pure strain of stiff-strawed barley of the very finest quality for brewing, indistinguishable from the best Chevalier varieties. It is now largely grown in Sweden, and has won many prizes. This fine result was reached by a knowledge of the law of correlation; eight good brewing barleys were available for distribution three years after the first choice was made, for the elimination of the other seven in further tests was only a refinement of selection. This principle of correlation has been found applicable to all the farm crops, even to the minor forage crops, and while it sheds a brilliant light to guide the improver of crops and provides a short cut to success, it effectually debars any but the trained specialist from the speedy introduction of new varieties by selection.

The two main principles of the work at Svalof have been stated; it remains to describe briefly the means and methods of their application. For the growth of the crops there is plenty of good land and the hundreds of acres of the seed farm if they are required; for the application of the law of correlation there is, first, a storehouse; second, laboratories and a museum; and third, a system of book-keeping marvellous in its scope and precision.

The Storehouse.—This is a very large barn-like building, in which the crops are arranged in sheaves or bundles attached to frames which are suspended from the roof. In front of the sheaves are gangways, many feet, it may be, from the ground, enabling the investigator to examine the sheaves without moving them or disturbing their order in the row. Here the first superficial examination is made, and many of the inferior sorts are discarded.

The Laboratories and Museum.—When the selected plants emerge from the storehouse they have to run the gauntlet of many ingenious instruments, of which the "classificator" is one of the most characteristic. A classificator is a collection of ears, pods, spikelets, grains--what you please. It may be

a collection of forty ears of barley, for example, arranged according to a definite character—let us say density. For each character there is a classificator, as for size, shape, hairiness, &c. An ear to be classified is moved along the row until it is obviously intermediate between two ears, one before and the other behind it, and as the ears are arranged on a scale marked by figures, the figure nearest to the ear investigated indicates the degree of the character in question.

Another example may be given. The quality of barley in one character is tested by means of its transparency in a diaphanoscope. The classificator is, therefore, a row of barley grains of different degrees of transparency arranged before a reflector of special construction. The grains to be tested are placed in a screen of similar nature and moved along the classificator until their transparency coincides with one of the standard grains. Kernels of cereals, peas, and vetches, stems for their calibre, leaves for their length and breadth, all come to the classificators to find their level. Other instruments collect from an ear or panicle the upper, middle, or lower grains as required, punching machines register on a dial the hardness of grains when divided, and automatic weighing machines extract light from heavy ears, twenty to the minute with absolute precision.

The museum would apparently provide ample material for research students for a generation. A student wishes to know if barley ·9246 is mutating after seven years in the trial plots. In the museum he will find six ears of the six previous years arranged tandem on a string; he will find dried specimens of the plants, boxes of the grain, and a description which has left nothing unobserved.

The Bookkeeping.—From the moment when a plant is first selected from the field it is registered by a number which it bears until it is put upon the market or discarded. The number consists of four figures; the first, a cipher to avoid confusion with other numbers; the second refers to the group, *i.e.*, Chevalier or Goldthorpe, for example, and the last two to the special sort, sub-race or strain. The morphological characters of any species are registered by a system of shorthand in which symbols stand for long descriptions; thus a row of symbols will indicate the precise nature of a wheat

Crop of Victory Oats, one of the First Selections—
A very heavy Crop.

'ield of Extra Square Head No. 2 Wheat on the Seed Company's Farm—
180 acres in extent and estimated to yield 70–80 bushels per acre.

(Oats in the foreground.)

individual, and only one who has actually seen a number of those plots can appreciate the remarkable differences which become noticeable in such a comparison, but which would remain unobserved in a mixed plot. From these plots it is easy to select the best, which is then transplanted to an isolated place beyond the chance of cross pollination, to provide pure seed for further trial or for the market. If mutants are wanted, the plants are grown side by side, and the progeny supply materials for selection. The former plan has been in operation only five years, and already three good new elementary species have been obtained.

These examples sufficiently indicate the scope of the work at Svalof, work which includes all the farm crops. Space prevents description of the work of the specialist on potatoes, but it is worth mentioning that the Canadian method of selecting potatoes, which does not seem to have had a fair trial in this country, is highly favoured at Svalof.

The General Swedish Seed Company.—The production of improved varieties of crops soon out-grew the capacity of the scientific staff to organise the sale of seed and oversee the commercial side of seed production. So in 1891 there was founded the General Swedish Seed Co., Ltd., for the purpose of increasing and distributing the new stocks. Its headquarters are at Svalof, but its buildings and staff are distinct from those of the scientific society, though so far as its agricultural activities are concerned, it is placed under the control of the Society. It can handle no seeds except those supplied from the laboratories, its machinery is approved by the Society, and every sack of seed sold has been inspected, certified, and sealed by the agents of the Society. The Company owns 1,500 acres round the trial grounds, and controls 3,700 acres for the further increase of the crops. All crops during the growing period are inspected by officials of the Society, and all seeds sold must pass through the headquarters warehouse of the Company where samples are taken and certificates given. The purity of the seeds sold by the Company is, therefore, beyond criticism. From figures of crop production obtained at Svalof, there appears to be no doubt that the new varieties introduced there have increased the cereal crops of southern Sweden from 30 to 50 per cent., but, apart from the

FIG. 21.—FLY AGARIC

(*Amanita muscaria*).

FIG. 22.—SHIELD AGARIC
(*Lepiota clypeolaria*).

figures, an inspection of the Seed Company's crops before harvest will convince the most sceptical of the unqualified success of Dr. Nilsson's method of improvement.

The results described have been obtained by selection only, but it must not be assumed that cross-breeding and the application of Mendel's law have been neglected at Svalof. Cross-breeding has been practised for ten years or more, and good results are expected from Mendelism, but the improved crops which have reduced Sweden's imports of wheat and increased the value of land in southern Sweden were put upon the market before Mendel's law had been rediscovered. A discussion of the work at Svalof on cross-breeding is beyond the scope of this paper.

The writer desires to express his gratitude to Dr. Nilsson and his colleagues, and to the manager of the Seed Company, for much information and for generous contributions of time and trouble.

POISONOUS VARIETIES OF FUNGI.*

FLY AGARIC (*Amanita muscaria*). (Fig. 21.)

This is one of the most brilliantly coloured and generally distributed of British fungi. Cap globose when young, gradually expanding and becoming quite flat when fully grown, 4 to 7 in. across, scarlet, with white patches. Stem 4 to 7 in. high, white, swollen below, and with a ring or frill near the top.

It occurs in woods, especially under birches and firs, or amongst bracken, and is very poisonous. The popular name, Fly Agaric, is derived from the fact that a decoction of the fungus was at one time used as a fly poison.

SHIELD AGARIC (*Lepiota clypeolaria*). (Fig. 22.)

The cap is at first cylindrical, smooth, brown, gradually expanding until flat, when every part of the surface except the central boss becomes broken up into small scales. The cap is 2 to $3\frac{1}{2}$ in. across; gills white, stem covered with small, spreading scales below the ring.

* The previous numbers of this series of coloured plates and descriptions have appeared in the *Journal* as follows:—Nos. 1–3, February, 1910; Nos. 4–6, March, 1910; No. 7, February, 1909; Nos. 8–10, April, 1910; Nos. 11–13, May, 1910; Nos. 14–16, June, 1910; No. 17, September, 1908; Nos. 18–19, July, 1910; No. 20, November, 1908.

This variety is found in late summer on the ground in woods and gardens. It often appears in greenhouses.

It may be distinguished from the edible kinds of *Lepiota* (*Lepiota procera,* Fig. 7, *Lepiota rachodes,* Fig. 9, and *Lepiota emplastra,* Fig. 10), by the scaly stem.

Ground Beetles (Carabidæ).

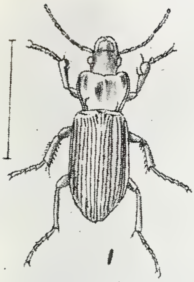
For several years past the Board have received, in the months of June and July, complaints as to damage done to strawberries by beetles, the specimens on examination proving to be Ground Beetles of different species.

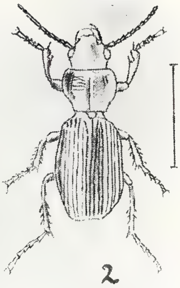
The Family Carabidæ.—The Ground Beetles are so called from their being commonly found on the ground and under stones, moss, or rubbish, or in the soil itself. The family *Carabidæ* is a very large one, the individuals being characterised by their five-jointed tarsi, a head generally narrower than the thorax, strong jaws, and legs fitted for running. Some have functional flying wings, others are wingless. The beetles are active, and are nocturnal in habit, hiding away in the daytime. The larva is a six-legged grub with prominent jaws; the body is elongated, the joints being of about equal breadth. The larvæ can further be recognised by their possessing two horny bristle-like projections at the tail end, with a tube-like process between them.

Ground Beetles as a family are carnivorous and predaceous both as adult and as larva, their prey being to a great extent insects. Some, however, have proved destructive to plants, and amongst them the Board have received from various correspondents: *Harpalus ruficornis*, Fab.; *Pterostichus vulgaris,* Linn.; *Calathus cisteloides,* Panz.; *Steropus madidus,* Fab. These four beetles, either singly or together, have proved very destructive to strawberries, and in one case in Cheshire (June and July, 1907), *Steropus madidus* proved a harmful enemy of mangolds.

The four beetles named are common from south to north, and can be distinguished as shown in the table on the next page.

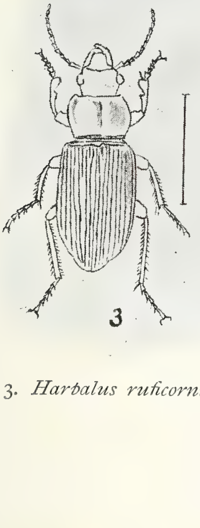
These beetles are active after nightfall; in the daytime they





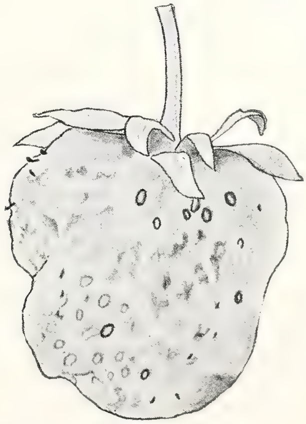
1. *Pterostichus vulgaris.*

2. *Steropus madidus.*



3. *Harpalus ruficornis.*

4. *Calathus cisteloides.*



STRAWBERRIES GNAWED BY GROUND BEETLES.

hide among the straw and litter of the beds and in the soil itself.

Damage to Strawberries.—The beetles sometimes make their appearance in great numbers, with the result that the complete crop may be ruined. A correspondent wrote from Norfolk in July, 1907: "The destruction by these beetles seems to have greatly increased in recent years. In 1897 all the strawberries in this neighbourhood perished, but since, there has not been trouble till the last four or five years." A correspondent from Reigate wrote in 1906: "The strawberries have been practically destroyed this year. My strawberries were attacked in the same way three years ago, but not in the last two years." A Sussex correspondent wrote: "The beetles have attacked the crops of my neighbour to such a degree that he could only get one pint of fruit where he ought to have had bushels. This is the third year that he has suffered from these pests."

	Harpalus ruficornis.	*Pterostichus vulgaris.*	*Calathus cisteloides.*	*Steropus madidus.*
Colour	Black	Deep black and shining	Black	Shining black
Length	½ inch and over	Up to ⅗-inch	Over ⅓-inch to about ½-inch	½-inch to about ⅔-inch
Thorax	Posterior angles sharp and projecting	Squarish with rounded sides. A distinct furrow runs down the upper surface. On each side are two depressions that run together	Squarish. Narrowed in front; wavy behind. The posterior angles are somewhat rounded. A distinct furrow on upper surface. Base with two depressions on each side.	Narrowing somewhat towards the base. Posterior angles rounded. A distinct dorsal furrow. Base with a depression on each side.
Wing-Covers	Dim, with a grey or a yellow-grey pubescence. Striated	Striated	Striated	Striated
Flying Wings	An excellent flier	No flying wings	No flying wings; or represented, but useless for flight	No flying wings

The fruit is attacked in all stages—green, coming to maturity, and mature. The succulent receptacle on which the "seeds" (achenes) are placed is gnawed; or the "seeds" may be picked out while the succulent part is spared. As one correspondent puts it: "I found strawberries with the seeds picked out, and in some cases the broken shell of the seed adhering to the flesh as if a nut had been cracked and the shell left behind." Bitten fruits discolour and wither away.

Damage to Mangolds.—A correspondent described the beetle (in this case *Steropus madidus*) as "playing sad havoc amongst his mangolds, gnawing the plant off at the top of the root."

Treatment.—1. In a garden, on a small scale, the beetles can be collected from their shelter places in the litter and soil of the beds, the soil being turned over to expose them.

2. Warburton records that raw meat covered with sacking is a good trap for the beetles. Such traps should be regularly visited.

3. In her Report for 1899, Miss Ormerod quotes the method of trapping practised by Messrs. Laxton Brothers, of Bedford: "We purchased a large quantity of cheap pudding-basins early this spring; these are let into the ground, level with the surface, at distances of a few yards apart, and kept baited with pieces of lights and sugar-water. When the weather was dry, we often caught half a basinful of a night until the number gradually diminished to two or three and now none at all. It is a laborious process, but we have lost no fruit this season."

4. In one case of infestation reported to the Board a market gardener saved half his crop "by tying up the bunches of fruit to strings stretched about the rows, the beetles being found not to leave the ground."

Use of Inferior Hay.

During the present season hay in some districts may prove of inferior quality owing to unfavourable weather. In such cases a little salt sprinkled over it when it is fed to animals will help to make it more palatable. It is now too late to add the salt to the rick, otherwise in cases where the hay is not thoroughly dry it is a good plan

to throw salt over each layer of hay as the rick is made up. The quantity required is about 15 lb. of salt to each ton of hay. This to some extent tends to prevent fermentation.

The quantity of salt added to the food may be at the rate of $1\frac{1}{2}$ oz. to $2\frac{1}{2}$ oz. per day for cattle, 1 oz. for horses, and $\frac{1}{2}$ oz. for sheep. A few pounds of sweet meadow hay well mixed in with hay of inferior quality has also a good effect.

The use of condiments is not in general to be recommended, but in cases where food would otherwise be unacceptable to live stock, as in the case of inferior hay, the addition of the seed of fennel, fenugreek, aniseed, or carraway may prove advantageous. A mixture of 10 parts of fenugreek and 1 part each of aniseed and carraway may be given at the rate of 1 oz. to 10 lb. of hay.

Report on Diseases of Animals.

The action taken by the Board of Agriculture and Fisheries during 1909 under the Diseases of Animals Acts is described in the Annual Reports [Cd. 5,113, price 1*s*.] prepared by the Chief Veterinary Officer (Mr. S. Stockman) and by the Assistant Secretary (Mr. A. W. Anstruther, C.B.).

Mr. Stockman's report deals with the veterinary questions which arose in connection with the administrative measures for the eradication of swine-fever, glanders, anthrax, and sheep scab, and is accompanied by a report on the experimental work carried out in the Laboratory in regard to epizootic abortion, trichinosis, Johne's disease, sheep scab, and some other diseases.

A case is mentioned in which preventive inoculation against swine erysipelas (described in Leaflet 227) was tried on a somewhat large scale, and proved very successful.

In collaboration with the Veterinary Departments of various African Colonies, observations are being made on the utility of immunising pedigree stock against redwater in this country before shipping them to Colonies where they would be liable to contract the disease on the pastures.* During 1909 forty pedigree cattle have been immunised against redwater and shipped to the Transvaal and the East African Protectorate. This brings the total number of animals so

* *Journal*, August, 1909, p. 395.

treated and despatched to 83; it is hoped that in a short time it will be possible to furnish a report on the value of this method.

In an appendix to the report, a paper is given which Mr. Stockman read in September, 1909, at the International Veterinary Congress at the Hague. This paper summarises the results of the investigations into swine-fever since 1905.

The report of the Assistant Secretary deals with the work arising in connection with the administration of the Diseases of Animals Acts, and Mr. Anstruther points out that the returns of outbreaks of diseases of animals during the year 1909 are, on the whole, very favourable. There has been no recurrence of foot-and-mouth disease in Great Britain. The number of outbreaks of swine-fever has fallen from 2,067 in 1908 to 1,650 in 1909, of sheep scab from 849 to 685, and of glanders and farcy from 789 to 533. In anthrax alone has there been an increase in the number of outbreaks reported, the figures for 1909 being 1,317, as against 1,105 in 1908.

With regard to swine-fever, the immediate outlook appears more hopeful than has been the case in recent years, but one of the greatest obstacles met with in dealing with the disease is the fact that it now constantly assumes a very benign form, so much so that the loss arising from its appearance on any particular premises is often apparently very slight. This benign or chronic form of swine-fever is, however, identical with the acute form of the disease, and the acute form may at any time develop from the chronic form. The fact that the disease often runs a mild course throughout an outbreak does not lessen to any considerable extent the danger of its being spread by contact between the diseased swine and other swine. The restrictions enforced must, therefore, in the public interests be the same wherever the existence of swine-fever has been confirmed, so far as regards the premises upon which disease has been detected. The fact that the disease in the milder form not infrequently passes unnoticed by the pig-owner renders the necessity for the maintenance of general restrictions on the movement of store swine from district to district more than ever imperative, and tends to increase the importance and usefulness of more stringent movement restrictions in areas in which outbreaks recur, and as to which the available evidence indicates that undetected centres of

the disease may exist therein, it being clear that in such circumstances the unrestricted movement of store swine, and their aggregation in markets, may be the means of spreading the disease from premises to premises.

It is of the first importance that agriculturists should be brought to recognise the necessity for the restrictions wherever the existence of swine-fever is established. Were it possible, consistently with the attainment of the object in view, to differentiate between the disease in the acute and in the chronic form, those responsible for the operations against the disease would be the first to avail themselves of any advantages which could be derived from such a differentiation, since they, more than anyone, recognise the difficulties of dealing with the chronic outbreaks with the necessary stringency. Unfortunately there is no line of demarcation between the two forms of the disease which can be adopted for administrative purposes, and there is no alternative but to persist in the line of action which has been decided upon.

Some objection has been raised to the slaughter by the Board, with compensation, of breeding animals on premises where swine-fever exists. In deciding to extend the practice of slaughter so as to include stock of this class, the main object of the Board was to place the owner in a better position to secure the speedy eradication of the disease from his premises and the consequent withdrawal of restrictions. Except, however, in cases where the construction of the premises is such as to render them unsuitable for the isolation of swine thereon, the slaughter is not insisted on in the face of objection by the owner. Such objection is rarely raised, as it is only in special cases that the owner is prepared to face the alternative of prolonged restrictions.

That the slaughter of breeding stock in connection with outbreaks of swine-fever is to any appreciable extent the cause for the reduction of the number of pigs kept in Great Britain, is, at least, very doubtful, and those who have put forward that view have not produced any very convincing evidence in its favour. Similarly, there seems to be little or no foundation for the suggestion that the general restrictions on the movement of swine have led to the diminution in the pig population.

The general position as regards sheep scab is summed up

as being decidedly hopeful, and especially so as regards Scotland. The progress towards the eradication of glanders is also satisfactory; anthrax, on the other hand, presents certain difficulties, and the further efforts necessary to bring the disease under better control are indicated.

The conditions prevailing in the transit of decrepit horses to the Continent were investigated during the year, and energetic steps were taken to bring about an improvement.

Egg and Poultry Demonstration Train.

The Agricultural Organisation Society and the National Poultry Organisation Society recently arranged for an egg and poultry demonstration train to visit twelve centres in South Wales, with a view to encourage a greater production of eggs and poultry, and secure to farmers and others more adequate returns by better methods of marketing produce through co-operative societies.

The train ran from April 15th to 23rd, in accordance with the programme, and attracted great attention. The Great Western Railway Company provided a large baggage van, which was fitted up with various appliances, and a saloon carriage was attached, which was used for meetings with local committees. The luggage compartment of this coach, connected with the demonstration car by corridor, was fitted up as a dark room for demonstrations in testing, and proved one of the most attractive and instructive parts of the work. At each centre visited the carriages were placed in a dock or siding, so that visitors could pass through.

The party in charge of the car included Mr. Edward Brown, Secretary to the National Poultry Organisation Society; Mr. Walter Williams, Organiser for Wales of the Agricultural Organisation Society; Mr. Verney Carter, Organising Secretary of the National Poultry Organisation Society; and Mr. David Thomas.

Throughout the entire journey, at almost every stopping-place, even where no halt was announced, people were at the stations to see the cars. In some cases during the few minutes there hurried visits were paid to the demonstration car. At two or three stations eggs and chickens were brought to the car for inspection. The places visited were as follows:—Llanelly, Cardigan, Whitland, Fishguard, Clynderwen,

Haverfordwest, Llanybyther, Newcastle Emlyn, Llandyssil, Llandovery, Llangadock, and Carmarthen.

In all, twelve places were visited, and the programme followed at all the centres was that on arrival the demonstration car was shunted into a siding and immediately thrown open to visitors. Mr. Verney Carter and Mr. David Thomas explained the exhibits and gave demonstrations, which in some cases extended over several hours. It was frequently necessary to regulate the number admitted, otherwise the cars would have been uncomfortably crowded. As a rule, there was a large number of people awaiting the arrival of the car, notably at Llanelly, Cardigan, Haverfordwest, Fishguard, Clynderwen, and Newcastle Emlyn. At the last-named the platform contained nearly 300 people.

In addition, meetings were held either in some convenient public building, or in three cases in the station-yard, at which the objects of the Societies were explained. The attendances were uniformly large, and the interest manifested very great.

As a rule, the Committee of the local Agricultural Cooperative Society met afterwards, and it is believed that these conferences will be productive of good results by leading these committees to take up the question of the co-operative sale of eggs. It is stated that the need for some such movement is undoubted. In Carmarthen and Pembroke production is much less than should be the case; in Cardiganshire more poultry are kept, but prices are unsatisfactory, and until better methods are adopted and enhanced returns secured, there is no encouragement to keeping more fowls. The prices realised at present, due to the unsatisfactory methods in vogue, are not sufficiently profitable to producers, who are dependent on hucksters and have practically no alternative markets.

The Relation of Co-operation to Small Holdings.

The Small Holdings Commissioners, in their Report for the year 1909, observe that one of the most important factors on which the success of the small holdings movement depends is that of co-operative organisation. The best results can only be obtained by means of some organisation which will put the small producer into

such a position as to enable him to obtain a fair return for his produce and satisfy his requirements as cheaply as possible. This can only be done by the formation of Co-operative Trading Societies on a sufficiently large scale to enable them to command the services of thoroughly competent managers and by affiliating the small societies to these large organisations. That this can be done is shown by the success of the Eastern Counties Farmers' Association, which, after less than six years' existence, has an annual turnover of approximately £250,000, and to which small local societies can be affiliated at a charge of only $1\frac{1}{2}d.$ a member.

If each small holder attempts to deal as an isolated unit, not only with the productive, but also with the distributive side of his business, it is certain that he cannot hope to obtain the best market prices for his produce. A striking instance of this occurred a few months ago when eggs were being sold at prices ranging from 7*s*. 6*d*. to 10*s*. per 120 in many parts of Wales, while at the same time the wholesale prices in London, Manchester, and other large centres were from 15*s*. to 16*s*. per 120. On the other hand, an instance of what can be done by business organisation to meet the competition from abroad is afforded by the experience of the Derby Co-operative Provident Society in connection with cheese. In 1901 the Society purchased for sale to its members a weekly average of 31 cwt. of Canadian cheese and only 5 cwt. of English cheese. The latter was bought from a firm of dealers who obtained their supplies from farmers in Derbyshire and Staffordshire at ruinously low prices, and who sold to retailers at prices which enabled the Canadians to cut out the English farmers in their own district. Last year the Society developed a trade with the English producer direct, with the result that they are now taking an average of 40 cwt. a week of Derbyshire cheese as against 26 cwt. of Canadian cheese. There seems no doubt that if all the large industrial distributive Co-operative Societies would undertake to organise the trade of the agricultural societies and to purchase their produce at fair market prices, they would be able to obtain the bulk of their supplies from home sources, and the producers could rely on far better prices than they now obtain from local dealers or hucksters.

The Commissioners suggest that County Councils ought to do everything in their power to assist in organising co-operative methods among the small holders they have established. It is not enough merely to provide the land and place men upon it to fare as best they can unaided, and they express a hope that Councils will seriously consider whether they should not make use of their powers under Section 49 of the Act and assist those societies which are endeavouring to organise co-operative methods among small holders. The Board have undertaken to give an annual grant to the Agricultural Organisation Society, which has enabled them to appoint three additional organisers, but this further assistance only enables the Society to touch the fringe of the question, and there is ample field for additional help. The County Land Agents might be instructed to use every opportunity of urging upon the tenants of the Councils the importance of adopting co-operative principles, and the Technical Instruction Committees might pay special attention to the needs of small holders in arranging their courses of instruction in agricultural education. Advice might be given as to the crops which can be grown to the best advantage in view of the particular requirements of the markets. It is too often the case that small holders with excellent markets almost at their doors obtain unduly low prices for their produce because they do not study their markets, and are content to grow what they think best without any inquiry as to whether it is the particular class of produce which is in demand in the locality.

Advance in the Prices of Farm Products in the United States.

The United States Congressional Record of May 27th, 1910, reports a speech in the Senate by Mr. Smoot regarding the advances which have taken place in the prices of farm products between 1896 and 1910. The prices of practically all commodities have shown some advance during the past few years, but the products of the farm show a much greater advance than do the prices of the products of mines and factories.

Mr. Smoot stated that "Farm land in the United States has advanced in value rapidly, and everything produced on

the farm has also advanced materially. The financial condition of the grain-raiser of the North-West, the general farmer of the Middle West, and the cotton planter of the South is better than ever before. Instead of having to market the grain as soon as harvested and the cotton as soon as picked, the producer is now in a position to hold his crop and market it to the best possible advantage. Financially the farmer has become independent. The rural free delivery and the telephone have placed him in touch with the world, and he is as familiar with current events as the city dweller."

The following statement of prices, taken from Bulletins No. 39 and No. 87 of the United States Bureau of Labor, shows that the prices of the leading farm products have practically doubled in the fourteen years.

Product.	1910, March.		1896, March.	
	s.	*d.*	*s.*	*d.*
Corn, per bushel	2	7	1	2
Wheat, per bushel	4	11	2	7
Cotton, per pound	0	8	0	4
Oats, per bushel	1	10	0	10
Rye, per bushel...	3	4	1	6
Barley, per bushel	2	11	1	3
Hay, timothy, per ton	71	0	47	6
Hops, per pound	1	5	0	4
Potatoes, per bushel	1	4	0	9
Flax seed, per bushel	8	11	3	8
Cattle, choice to extra steers, per 100 pounds	34	2	17	9
Hogs, heavy, per 100 pounds	44	3	16	3
Butter, dairy, per pound	1	4	0	10
Eggs, per dozen	1	1	0	6

Mr. Smoot also furnished a number of tables showing the exchange value of these products expressed in terms of other commodities purchased by the farmer.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

Experiments with Grass and Clover.

Manuring of Grass Land (*Rothamsted Expt. Stat., Rept.*, 1909).—The Park grass plots have been mown for hay under, in most cases, the same systems of manuring, for fifty-three years. This report contains the weights of the crops in 1909, and a determination of the botanical composition of the herbage. In January, 1907, 2,000 lb. per acre of ground quicklime was applied to one-half of a number of the plots, and it is stated that great contrasts are now to be observed

* The summaries of agricultural experiments which have appeared in the present volume have been as follows:—Cereals, April; Cereals and Root Crops, May; Root Crops, June; Root Crops and Potatoes, July. The Board would be glad to receive for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

between the limed and unlimed portions of the plots that have become acid through the long-continued use of ammonium salts. On the acid portions the patches of dead herbage are extending, while the limed portions have come back to a normal appearance.

Manuring of Grass Land (*Roy. Agric. Coll., Cirencester, Scientific Bulletin, No.* 1, 1909).—Experiments on the manuring of grass that is mown for hay each year have been carried out on sixteen plots for twenty years, and on four other plots for seventeen years. The soil is a calcareous loam, rich in potash and nitrogen, and with a fair amount of phosphates, but varying considerably in depth and texture, and especially in the amount of carbonate of lime contained in it. The same manures were used each year. The main conclusion drawn is that on this soil no one simple manure, *e.g.*, phosphates alone, is economically effective on grass. Phosphates and nitrogen are required, and this, or a mixture with the addition of a little kainit, gives a remunerative return during a series of years. The mixture which gave the best results, taking the average of twenty years, was superphosphate, 5 cwt.; kainit, 5 cwt.; and nitrate of soda, 2½ cwt. This produced a crop of 37¾ cwt. per acre, compared with 19¾ cwt. on the unmanured plot, an increase of 18 cwt. The same quantities of superphosphate and nitrate of soda without the kainit gave nearly as good results, the increase being 17⅛ cwt. per acre. It is recommended that in actual practice rather smaller quantities of the artificials should be used, and that they should be applied earlier in the season than is the usual custom. With 12 tons of farmyard manure the average increase over the unmanured plot was nearly 16 cwt. per acre, the same result being given by 5 cwt. each of superphosphate and kainit and 2 cwt. of sulphate of ammonia. The quality of the hay was usually better, however, with sulphate of ammonia than with nitrate of soda. On this soil superphosphate appears to be generally preferable to basic slag. In the report physical and chemical analyses of the soil are given, and the crop on the different plots in each year since 1889 is shown.

Manuring of Meadow Land (*Field Expts. at Harper Adams Agric. Coll. and in Staffs. and Salop, Rept.,* 1909).—The effect of continuous manuring of meadow land mown each season is being ascertained on a pasture on stiff clay loam. Ten plots have been manured, in most cases every year, since 1903, and two more were added in 1908. They are mown each season, and grazed during the winter months. In 1909 the crop, with no manure, amounted to only 12 cwt. per acre. The greatest increase on this was obtained on the plot receiving 3 cwt. superphosphate and on that with 3¾ cwt. basic slag, the crop in both cases being 1 ton 10 cwt., and the profit £1 16*s.* 10½*d.* per acre and £1 17*s.* 9½*d.* per acre respectively. The quality of the herbage on all the plots where superphosphate has been used is very greatly improved, and this, together with the value of the aftermath, would increase the profitableness of the manuring.

Another experiment was begun in 1909 to test the value of the new potassic superphosphate manure. Four cwt. of this gave better results than either 365 lb. superphosphate and 81 lb. kainit, or 365 lb. superphosphate alone, but at a rather greater cost.

Manuring of Grass Land (*Univ. Coll., Reading; Bul. vii., Results of Expts. at the College Farm,* 1909; *Bul. v., Expts. conducted for the*

Oxfordshire C.C., 1909; *Bul. vi., Expts. conducted for the Bucks C.C.*, 1909).—These experiments are being conducted at the College Farm, at ten centres in Oxfordshire and at seventeen centres in Buckinghamshire, the object being to ascertain the effect of the chief artificial manures when used singly and in combination on the quantity and quality of the herbage. The plan of manuring is the same at all. One plot is dressed with 1 cwt. nitrate of soda, 5 cwt. basic slag, and 3 cwt. kainit per acre; on three others two only of these constituents are applied in the same quantities, while three plots receive the single manures. There is also a plot dressed with sixteen loads of dung. At some centres where lime is abundant in the soil superphosphate is substituted for basic slag. At the College farm the experiment has now been carried on for three years, and the crop without manure has on the average been 1 ton 18 cwt. per acre. Nitrate of soda, kainit, and basic superphosphate applied singly have produced but little increase. Dressings of the three fertilisers together, of 1 cwt. nitrate of soda and 3 cwt. kainit, and of 1 cwt. nitrate of soda and 5 cwt. basic slag, have been the most effective, the average crop in each case being about 2 tons 7 cwt.; a similar result was obtained from sixteen loads of dung.

In Oxfordshire the experiment has only lasted one year, and no conclusions are drawn at present.

In Bucks four years' results have been obtained from three of the centres, and three years' results from eight centres. The average crop from fifteen centres without manure has been 1 ton 7 cwt.; the dung and the complete dressing of artificials have both increased this to about 2 tons. None of the incomplete dressings have been so effective, the best results from them being obtained from 1 cwt. nitrate of soda and 5 cwt. basic slag, with which the crop was 1 ton 17 cwt., and of the single manures, from 5 cwt. basic slag, the crop being 1 ton 14 cwt.

Manuring of Grass Land (Cumberland and Westmorland Farm School, Newton Rigg, Rept. 1908–9).—The trial plots have been under experiment for twelve years. They have been manured every third year, in the other years the crop being dependent upon the residual manurial matter in the soil. The average crop without manure during the twelve years has been 29 cwt. per acre. Ten tons of farmyard manure increased the crop by 12 cwt. The most effective of the artificial manures was a mixture of $\frac{3}{4}$ cwt. nitrate of soda, $1\frac{1}{2}$ cwt. kainit, and 3 cwt. superphosphate, which gave an average increase of 9 cwt. per acre. Sulphate of ammonia and basic slag have not been quite so good on this soil as nitrate of soda and superphosphate.

Manuring of Grass Land (*East Sussex Educ. Com., Rept. on Meadow Hay Expts.*, 1909).—Manurial trials were conducted on twenty farms, but as the results from a few were not considered reliable, those from seventeen only are used in finding the averages. The average crop on the unmanured plots was 31 cwt. 3 qr., a very satisfactory yield. Ten tons of farmyard manure were applied on three plots at each of the centres, and the average yield of these fifty-one plots was 41 cwt. 3 qr., an increase of 10 cwt. In alternate years these plots will receive a dressing of artificials, no manure being given in the intermediate year. A complete dressing of artificials, composed of $1\frac{1}{2}$ cwt. nitrate of soda, 2 cwt. superphosphate, and 2 cwt. kainit, produced

practically the same increase, viz., 10 cwt. 3 qr. This mixture did not give quite the heaviest crop, but it was the most profitable. Its cost was 26*s.* 5*d.* per acre, and if the hay is valued at 3*s.* per cwt. a profit of 5*s.* 10*d.* per acre resulted from its use. The omission of any one of the ingredients reduced the crop. Kainit was erratic, each centre needing to be studied separately.

Manuring of Grass Land (*Monmouth Educ. Com., Rept. of Director of Agric. Educ., Oct. 20th,* 1909).—Trials were carried out in 1909 on four farms in the county. On three farms, where the same system of manuring was adopted, the best results were given by 8 cwt. superphosphate and 2 cwt. nitrate of soda. Eight cwt. dissolved bone did well on two farms. This last did better than the same quantity of either basic slag or superphosphate. On the fourth farm only manures supplying phosphates and potash were used on two sets of plots, and here 12 cwt. superphosphate per acre gave the best results. Ten cwt. and 12 cwt. of basic slag also gave satisfactory yields.

Manuring of Grass Land (*Herefordshire C.C., Rept. on Trials on the Manuring of Meadow Land*).—Twelve plots of meadow land on two different soils have been manured for the last four years. At Weirend, Ross, the land, which is by the River Wye, is a sharp, hungry sand, from which the finer particles have probably been removed by the action of the river, and is deficient in carbonate of lime. Here the results of the manuring have been disappointing, but the results were to some extent affected by the dry seasons of 1908 and 1909. The only plot which yielded an appreciable profit over the cost of the manures was one that received in alternate years 10 tons of farmyard manure, and in the other years 102 lb. sulphate of ammonia, and 352 lb. superphosphate. With this system of manuring the crop was increased by $13\frac{7}{16}$ cwt. per acre, which, at £3 per ton, gives a surplus of 5*s.* 11*d.* per acre over the cost of the manures. As the slight effect of the dressings may be partly due to the lack of lime in the soil, a dressing of lime is to be applied this winter.

At the second centre, Moreton Jeffreys, the soil is heavy and retentive, and all but one of the dressings produced a profit. The farmyard manure plots were the most satisfactory in this respect, the plot receiving farmyard manure and artificials (102 lb. sulphate of ammonia and 352 lb. superphosphate) being the best. These are followed by the plots receiving basic slag in regard to profit, though not in weight of crop.

Manuring of Poor Grass Land (*Devon County Agric. Com., Rept. on Field Expts.,* 1907–9).—Trials have been carried out on poor down land at Collacombe Down, Tavistock, and also at Heathfield, Tavistock, where the soil is somewhat of a moorland type.

At Collacombe Down, it was soon observed that basic slag produced a good growth of White Dutch Clover, this effect being favoured by the damp character of the climate. A chemical analysis of the soil showed that there was a deficiency of phosphate, potash, and carbonate of lime. Manures were first applied in the spring of 1907, and but little improvement was visible in that year. Further small dressings of phosphates and potash were applied in 1908. The plot receiving basic slag and kainit made a marked advance, closely followed by the plots having basic slag alone, and those having superphosphate and lime.

The limed plots showed no improvement whatever, except where phosphate was applied. The effect of lime seemed to produce a more vigorous growth of weeds. In February, 1909, phosphates and kainit were again added, and nitrate of soda in April to some of the plots. Owing to the character of the grasses which are present the nitrate of soda did not produce sufficient herbage to pay.

Another trial was made at Cofyns, Spreyton, the soil being a poor clay on the Culm measures. When the manures were applied in February, 1909, there was scarcely a leaf of clover to be seen, and the field presented a starved appearance. During the summer, however, the whole field altered, and a thick growth of nutritious clover developed before the end of the autumn. The manures applied included phosphates, potash, and lime, in various forms and combinations.

Manuring of Grass Land (*Wilts C.C., Results of Field Manurial Demonstrations,* 1908–9).—Experiments on the manuring of meadow grass for hay were carried out at four centres in the county. Eleven plots of $\frac{1}{20}$ acre at each were dressed with sulphate of ammonia, basic slag, superphosphate, and kainit, singly and in various combinations, the quantities used being :—Sulphate of ammonia, 100 lb.; basic slag, 220 lb.; superphosphate, 335 lb.; kainit, 160 lb.

The season was unfavourable to hay, and the results at the different centres varied considerably. At one, where the weather was most adverse, the increased crop produced by the manures was not sufficient to pay their cost. At the others the applications were usually profitable, the mixed manures giving better results in this respect than single dressings.

Manuring of Pasture (*Somerset C.C. Agric. Instr. Com., Report for period ending March* 31*st,* 1910).—This experiment was designed to find the best manuring for poor pasture land on Brendon Hill, where lime is said to act with marked results, and on the Blackdown and Quantock Hills. Ground burnt lime, phosphatic dressing alone, and phosphates together with kainit, were used, and a cross dressing of 10 cwt. of ground lime was carried across one-third of all the plots. The land is not to be mown, the improvement being determined by inspection. The trial was started on four farms in 1908–9, and on two in 1909–10. In the case of the former a distinct improvement was noticeable last summer on the plots receiving slag or superphosphate alone, or these substances along with kainit, though there was little, if anything, to choose between any of these four plots. So far the ground lime, either alone or as a cross dressing, gave little result, while the plot getting kainit alone was, at each centre, no better than those with no manure.

Manuring of Seeds Hay (*Midland Agric. and Dairy Coll., Bul.* 2, 1909–10).—These trials were started in 1904. For the first three years they were of a preliminary nature, but served to demonstrate that the crop is one that can, in the average case, be profitably treated with artificial manures, and also that nitrogen alone, *i.e.,* nitrate of soda or sulphate of ammonia, is not so profitable a dressing as nitrogen accompanied by phosphate. For the last three years a more definite scheme of tests has been carried out to compare different dressings of artificial manures. Twelve plots of $\frac{1}{20}$ acre have been manured at each centre, great care being exercised to secure land as even as possible in character and plant. Two plots were left unmanured, two received

nitrogen and phosphates, and six a complete dressing of varying composition. The manures used were nitrate of soda, sulphate of ammonia, superphosphate, and three forms of potash, viz., muriate of potash, sulphate of potash, and kainit. Quantities of these were applied sufficient to supply 20 lb. of nitrogen, 25 lb. of phosphoric acid, and 25 lb. of potash.

This scheme has been carried through at twenty-one centres in the three years, but the returns from sixteen only are considered reliable. Taking the average of these, the most profitable dressings have been the following:—(1) 100 lb. sulphate of ammonia; 208 lb. superphosphate; 200 lb. kainit; all applied within the first fourteen days of April; (2) 100 lb. sulphate of ammonia, 208 lb. superphosphate, both applied within the first fourteen days of April; 50 lb. muriate of potash, applied within the first fourteen days of March. Each of these dressings, costing about 19*s.* 3*d.* per acre, has given an increase of 10½ cwt. of hay over the unmanured plots, which, valued at £3 per ton, leaves a profit of about 12*s.* 6*d.* per acre, due to the manures. The experiment is to be continued.

Manuring of Ryegrass and Clover (*Lancs. C.C. Educ. Com., Agric. Dept., Farmers' Bulletin* 15).—In 1906 and 1907 an experiment on the manuring of ryegrass and clover (1st year's "seeds") was carried out on eleven farms in Lancashire. Only artificial manures were used. Nitrate of soda alone, and with superphosphate in addition, produced a satisfactory increase in the crop, but the best results were given by a dressing of 1 cwt. nitrate of soda, 2 cwt. superphosphate, and 1 cwt. muriate of potash, and this is recommended for the crop where clover is fairly abundant. If on inspecting the young "seeds" it is found that ryegrass forms the bulk of the herbage the muriate of potash may be reduced and the nitrate of soda increased. With the mixture recommended, the yield of the crop (first cutting) was 11½ cwt. above that without manure, and the profit from the dressing after deducting its cost was 9*s.* 11*d.* per acre. The largest yield was produced by the plot receiving 2 cwt. nitrate of soda and 2 cwt. superphosphate, which left a profit of 16*s.* 8*d.* per acre, but the character of the herbage detracted much from its value. Without nitrogenous manure the growth of the clovers was promoted, but the plot lacked height and growth of ryegrass, while the use of sulphate of ammonia early in the year and the forcing of the ryegrass by heavy applications of nitrate of soda impaired the abundance and strength of the clovers.

The whole cost of the manures was charged against the first crop in calculating the results, but notes were taken on the growth of the aftermath, and the effect of the manures was shown to be by no means exhausted by the first crop. The complete mixture produced in the aftermath a better herbage than incomplete mixtures.

Seeds Mixtures for Permanent Pasture (*Univ. Coll. of N. Wales, Bangor, Bul.* 6, 1909).—Plots on nine farms were laid down with four different seeds mixtures in 1906. Each plot was ⅓ acre in size. The following notes will give an indication of the nature of the mixtures:—

Mixture A.—Contains a considerable quantity of Ryegrass and more Red Clover than any of the others. It approaches more nearly to the mixtures usually sown by farmers than B, C, or D. Weight per acre, 31½ lb.; cost £1 0*s.* 11*d.*

Mixture B.—Contains less Perennial Ryegrass, but a larger number of other grasses and pasture plants. Part of the Red Clover is replaced by Alsike. The price of this mixture is somewhat higher than that of mixture A. Weight per acre, 28¾ lb.; cost, £1 2*s.* 4*d.*

Mixture C.—Italian Ryegrass is omitted and larger quantities of some of the stronger growing permanent grasses together with a few bottom grasses introduced. This mixture is more expensive than A or B. Weight per acre, 33¾ lb.; cost, £1 10*s.* 1*d.*

Mixture D.—This is one of those recommended by Mr. R. H. Elliot, of Clifton Park, Kelso. It contains no Perennial Ryegrass, but a larger number than usual of other pasture plants, including Burnet, Chicory, and Kidney Vetch, which until recently have not been included in seed mixtures. These are deep-rooted plants, and in dry seasons may be useful on account of their drought-resisting properties, especially on light soils. Weight per acre, 47½ lb.; cost, £2 9*s.* 9*d.*

The plots were mown in 1907 and 1908, when mixture D yielded the greatest weight of hay. Mixture A also yielded a very satisfactory crop, especially in the first year.

In 1909 the experiment was continued at seven of the centres, the plots being grazed and inspected during the summer. The plots sown with mixtures A and B were then poor and thin, B being a little the better of the two, owing to the slightly larger proportion of perennial grasses. C was on the average much better, and with a large percentage of strong permanent grasses, and a close bottom herbage of finer grasses and yarrow, it gave every indication of providing a thick close sward. Mixture D was decidedly the best in appearance. The finer grasses and yarrow, which were particularly good, in some cases almost gave to this plot the appearance of an old pasture. Practically all the Sheeps' Parsley, Burnet, and Kidney Vetch had disappeared. While it is too soon to draw definite conclusions as regards the suitability of the different mixtures for forming permanent pasture, it is considered that there is every indication that the more expensive mixtures used on plots C and D will prove to be the cheapest in the long run. A mixture such as that used on plot A, while giving satisfactory hay crops in the first year or two, contains a very small proportion of permanent grasses, and would appear to be quite unsuited for forming permanent pasture.

A further experiment with three of the same mixtures, and with a modification of D in order to make it less expensive, was started in 1909.

OFFICIAL CIRCULARS AND NOTICES.

Advisory Committee on Agricultural Science.

The Committee appointed to advise the Board of Agriculture and Fisheries on all scientific questions bearing on the improvement of agriculture held its first meeting in Committee Room A, House of Lords, on the 29th July.

In the unavoidable absence of Lord Carrington, Sir Thos. Elliott, K.C.B., Permanent Secretary of the Board, presided, and explained the policy of the Board in appointing the Committee. The Committee subsequently discussed the best methods of carrying out the work entrusted to them, and appointed sub-committees to deal with particular sections of the subject.

Rural Education Conference.

The Minute, dated February 4th, 1910, constituting a Rural Education Conference referred to in the Memorandum of Arrangements * between the Board of Agriculture and Fisheries and the Board of Education in regard to agricultural education, has been printed pursuant to an Order of the House of Lords [H.L. 63. Price ½*d*.] This document also contains a further Minute, dated June 20th, 1910, which gives the names of the members of the Committee, and empowers the Conference to appoint Committees to consider and advise upon particular sections of the subject. The names of the members were given in this *Journal*, July, 1910, p. 318.

The Minute constituting the Conference is as follows :—

1. We have agreed upon the following constitution of the Rural Education Conference referred to in paragraph (1) of our Memorandum of Arrangements between the Board of Agriculture and Fisheries and the Board of Education in regard to Agricultural Education in England and Wales, dated September 22nd, 1909, and laid before Parliament (White Paper Cd. 4886).

2. The Conference shall consist of 42 Members, of whom six, to be called Official Members, will be nominated by ourselves, and the rest, to be called Representative Members, shall be nominated, for a term of three years in each case, as set out hereunder :—

REPRESENTATIVE MEMBERS.

1 by the University of Oxford,
1 by the University of Cambridge,
1 by the University of Durham,
1 by the University of Leeds,
1 by the University College of Wales, Aberystwyth,
1 by the University College of North Wales, Bangor,
3 by the County Councils Association,
3 by the Agricultural Education Association,
3 by the Royal Agricultural Society of England,
2 by the Central Chamber of Agriculture,
2 by the Bath and West and Southern Counties Society,
2 by the Central Land Association,
1 by the Farmers' Club,
2 by the Surveyors' Institution,
1 by the Land Agents' Society,
1 by the North Eastern Agricultural Federation,
1 by the Yorkshire Union of Agricultural Clubs and Chambers of Agriculture,
1 by the Lancashire Farmers' Association,
1 by the National Farmers' Union,
1 by the Welsh National Agricultural Society,
1 by the Agricultural Organisation Society,
2 by the Royal English Arboricultural Society,
2 by the Royal Horticultural Society,
1 by the British Dairy Farmers' Association.

3. The Conference will also be attended by such Officers of the two Boards as may be nominated by their respective Presidents to

* *Journal*, October, 1909, p. 529.

take part in its deliberations, and to supply information or to give explanations with regard to any questions that may be raised. The Presidents of the two Boards may by a Joint Minute from time to time add to or otherwise alter the constitution of the Conference; but they will give two months' notice of any alteration entailing the withdrawal or decrease of any of the representation given by this Minute.

4. The Conference will be summoned from time to time as occasion may require, by a Minute signed by ourselves, or by such Officers of the Boards as we may respectively authorise to sign on our behalf. A Preliminary Meeting of the Conference shall be summoned as soon as possible to discuss general questions affecting the conduct of the business of the Conference. Two months' notice shall be given to each Member of the Conference of all the subsequent Meetings. There shall not be more than two Meetings of the Conference in any calendar year, provided that the Preliminary Meeting referred to above shall not count for this purpose as a Meeting of the Conference.

5. There shall be a Chairman of the Conference, who shall be nominated by ourselves for a term of three years from amongst the Members of the Conference.

6. There shall be two joint Secretaries of the Conference, who shall be Officers of the Board of Education and of the Board of Agriculture and Fisheries respectively. The first Secretaries of the Conference shall be Mr. H. A. Kennedy, of the Board of Education, and Mr. H. L. French, of the Board of Agriculture and Fisheries, who shall continue to hold this office until the appointment by us of their successors.

7. The primary duty of the Conference shall be to discuss and to advise the two Boards upon all questions connected with Education in Rural Districts which may, from time to time, be referred to them by the two Boards. Notice of the questions thus referred for discussion shall be forwarded to each Member of the Conference by the Secretaries, and this notice shall, so far as possible, be given at the same time as notice of the next Meeting of the Conference.

8. Any Official Member of the Conference, and any Representative Member duly authorised so to do by the Association or Body which he represents, may suggest questions for discussion in addition to those questions formally referred to the Conference by the two Boards. Any Member of the Conference desiring to propose a question for discussion, in accordance with this paragraph, shall give notice of his intention to the Secretaries of the Conference, and this notice shall be given not less than four weeks before the Meeting of the Conference at which it is proposed that the question should be discussed. The Secretaries will at the earliest possible date inform the Members of the Conference of any such proposals.

9. A Report of the proceedings of each Meeting of the Conference, signed by the Chairman, shall be forwarded in duplicate to ourselves, as soon as possible after the Meeting.

(Signed) CARRINGTON,
President of the Board of Agriculture and Fisheries.
(Signed) WALTER RUNCIMAN,
President of the Board of Education.

February 4th, 1910.

The Water Supply of Hampshire.

The Board of Agriculture and Fisheries desire to draw attention to the publication of a memoir of the geological survey on the water supply of Hampshire (including the Isle of Wight). The memoir is the eighth of a series dealing with the water supply derived from underground sources. The introduction contains particulars of the geological formations of the county, with especial reference to the water-bearing strata. Wells, borings, and springs, with supplies therefrom, intermittent streams, contamination of water, and analyses of various waters are also dealt with in the succeeding chapters. In addition the memoir is accompanied by a rainfall map of the county with explanatory report and statistics, and also a map of the valleys of the Test and Itchen, showing the position of wells and the contour lines in the surface of the underground water. A bibliography of works relating to the water supply of the county is included. Copies may be obtained from any agents for the sale of Ordnance Survey maps, or directly, or through any bookseller, from the Ordnance Survey Office, Southampton, price 5*s.*

Harvest Weather Forecasts.

Until the end of September the Meteorological Office will, as in past years, supply forecasts of weather by telegraph to persons desirous of receiving them, upon payment of the cost of the telegrams. The forecasts are drawn up each week-day at 2.30 p.m., and refer to the probable weather during the fifteen hours from 6 a.m. to 9 p.m. on the next day. A note as to the further outlook is given when possible. Forecasts are also prepared at 9 a.m. and 7 p.m., and can be sent in lieu of the afternoon telegrams on payment of 1*s.* 6*d.* per week in addition to the cost of the telegrams.

Applications for the forecasts should be sent to the Director, Meteorological Office, 63 Victoria Street, London, S.W., with a cheque or postal order to cover the cost of the telegrams for the period, which should be not less than six consecutive days, during which the forecasts are to be sent. The telegrams are estimated to consist of sixteen words, exclusive of the address, but if the cost is less than this estimate the balance will be refunded.

The office is also prepared to send notification by telegram when the conditions appear favourable for a spell of settled fine weather. The notification will take the form of a forecast covering a period of not less than two days following date of issue. Those who wish this notification must deposit a fee of 2*s.* 6*d.*, which includes cost of telegram.

Foot and Mouth Disease in Yorkshire.

Foot and mouth disease reappeared in this country on July 21st on a farm at Kirkby Malzeard, near Ripon, in the West Riding of Yorkshire. Measures were at once taken to prevent the spread of the disease to other premises, the movement of cattle, sheep, goats, and swine being prohibited in a wide area around the seat of the outbreak.

All the available evidence goes to show that the disease existed at

the time at no other centre, and so far it has spread only to an adjoining park, where a yearling bullock was discovered to be affected on July 26th. The circumstances of these outbreaks were such as to justify the slaughter, with compensation, of all the animals which had been exposed to the risk of infection, and there is good reason to believe that the outbreak has been brought under control by the action taken, no other centres of disease having come to light. The Board have therefore been able gradually to modify the restrictions, except in the immediate vicinity of the infected places, where the movement of animals is still prohibited. Up to the 10th of August the efforts made to trace the origin of the outbreak had not been successful.

MISCELLANEOUS NOTES.

Demand for Agricultural Machinery Abroad.

Agricultural Implements for Burma.—The *Indian Trade Journal* (May 26th, 1910) contains an article by Mr. A. McKerral, M.A., B.Sc., Deputy Director of Agriculture, Burma, in which it is pointed out that the principal difficulties in the way of the introduction of European implements into Burma are that they are too heavy, too complicated, and too costly.

In Burma there are two main agricultural tracts: (1) Lower Burma, where practically the only crop is rice, grown under natural rainfall; and (2) Upper Burma, or the dry zone, as it is called, where millets, ground nut, sesamum, cotton and legumes are grown. For the first tract the most obvious introductions in the way of machinery are light reaping machines, capable of working in small fields of a quarter or half an acre and of being removed from one field to another. If a really serviceable machine of this sort can be got at a cost of not more than Rs. 200 there is no doubt it will sell. Next in order come threshing machines for hand or bullock power. They ought to have a "drum" which would effectually remove and separate the grains of paddy, and should be light, on wheels if possible, and capable of being moved from one field to another. The present type of winnowers makes transit difficult, although it does quite good work with paddy when it is placed in position. Something capable of being dragged on wheels from one field to another is required, and this would necessitate a broader and lower type. In the event of threshers not being used and threshing done by cattle in the usual way, a winnower is required which will remove rapidly the long straw from the grain and remove the small lumps of soil which come from the threshing floor. This latter difficulty has been found to be very great in Upper Burma, as, from the nature of the soil, fragments of it of about the same diameter as the grain pass through with the grain, being too heavy to be blown out with the chaff.

In the Upper Burma tract there is little hope of introduction of any but the very cheapest and simplest implements, as the people are small holders and generally poor. The crying need at present is to induce cultivators of cotton, maize, peas, &c., to adopt the drill system of cultivation. It is suggested that manufacturers should study the Indian seed drill, and endeavour to improve it by some very simple

mechanical device for the automatic distribution of the seed. At present one man is required to drive the bullocks and another to put in the grain. For the subsequent cultivation a light, cheap, and efficient form of drill harrow is necessary. Some of the American types at present used do well in the light soils, but they are too complex.

The time is ripe for engineering firms to tackle the question seriously and on the spot by men who make it their business to understand the requirements and resources of the cultivators. It is hopeless to attempt to graft advanced methods on a primitive people. Progress at first will undoubtedly be slow, but if proper methods are adopted, success is sure to follow.

Probable Demand for Agricultural Machinery in Asia Minor.—Mr. Consul-General Lorimer's Report on the Trade of Baghdad for 1909 (*F.O. Reports, Annual Series, No.* 4482) states that the Turkish Government have appointed a director of agriculture for Baghdad. It is understood that he has advised the establishment of an agricultural bank and an agricultural school, and that he is urging the larger owners of land to adopt modern ploughs and mechanical reapers and threshing machines. Simultaneously Sir William Willcocks' irrigation schemes are in course of execution. These factors are likely to conduce, sooner or later, to a demand for agricultural machinery of all descriptions. The importance of the market, which may thus come into existence, can be judged from the extent of the lands—some millions of acres—which may eventually become available for cultivation. It will also be determined, however, in some degree by the form of land tenure that may come into vogue and the proportion of large to small landowners.

Ploughs and agricultural machinery should be of light make, and they must be cheap in order to tempt the native experimenters. The soil is clay and sand, not heavy, and the draught animals being small, light ploughs are essential. There are no made roads, and machines would have to cross unbridged ditches and water channels in doing their work, hence they should be light in weight and strong and simple in construction in order to suit the conditions of the country.

The only available kinds of fuel are kerosene, wood and brushwood. No coal or electrical power is procurable. These facts should be borne in mind in constructing engines to produce motive power for driving or drawing machines.

An enterprising French firm has already supplied its agent at Baghdad with two sample ploughs, but these are said to be unsuitable and too heavy for the local requirements.

German firms established in Anatolia and Syria are said to supply ploughs and machinery to landowners and farmers there on the hire or the payment on instalment system. Some similar system would need to be adopted here to make the use of agricultural machinery popular.

Importation of Machinery into France.—Mr. Consul Payton, in his report to the Foreign Office on the trade of Calais in 1909 (*Annual Series, No.* 4491) remarks that his attention has been drawn to the

difficulties experienced at the customs by importers of British machinery since April 1st, when the new tariff came into force. To avoid trouble and possible fines, the following rules should be observed :—

1. On declaration at customs a plan or drawing of the machine must be produced.

2. The weight of the machine must be given *very exactly*.

3. Extra change pieces should be packed apart from the machine, and declared separately.

Notes on Agriculture Abroad.

*The Soy Bean Industry of Manchuria.**—The following information is taken from the report by H.M. Consul at Newchwang (Mr. F. E. Wilkinson) on the trade of that district in 1909 (*F.O. Reports, Annual Series, No.* 4440).

The consumption by Manchuria of beans and bean cake is small. Beans, except to a limited extent in the form of bean curd or vermicelli, which is made from the green variety, do not enter into the diet of the population, nor is any use made by farmers of bean cake either in manuring their fields or feeding their cattle. The staple food of both man and beast in South Manchuria is millet, and for the rich soil in the interior the ordinary farm manure is the only fertiliser needed. It is probable, therefore, that at least 90 per cent. of the total crop of South Manchuria is available for export, which takes place mainly through the two ports of Newchwang and Dairen (Dalny). In 1909, 178,000 tons of beans and 318,000 tons of bean cake were exported from Newchwang, and 438,000 tons of beans and 276,000 tons of bean cake from Dairen, making a total of 616,000 tons of beans and 594,000 tons of bean cake. It is estimated that the total quantity of beans represented by the combined exports of bean produce from South Manchuria was about 1,300,000 tons.

Previously to 1909 the bean trade of Manchuria was entirely in the hands of Chinese and Japanese merchants, there being no demand for Manchurian beans elsewhere than in China and Japan, and, as the supply almost invariably exceeded the demand, the farmers rarely got more than the merest pittance for their harvests. At the time of the first shipments to Europe the price of beans laid down at Dairen was about £3 10*s*. per ton. By the spring of 1909 the value of the soy bean as an article of commerce had become generally known, and, a large number of British and other firms entering the field as prospective buyers, competition gradually drove the price up. The new crop, though well up to the average, proved not to be equal either in quality or quantity to that of 1908. The price of beans consequently rose still further, and in February, 1910, it reached £6 5*s*. per ton, the highest point it has touched as yet. At the price mentioned, China and Japan are practically out of the market as buyers, and about 80 per cent. of the purchases of beans made since December last have been for the European market.

Use of Soy Bean Cake as a Fertiliser in Japan, and probable effect of the European Demand.—The following information is taken from

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* Information as to production of Soy beans and their use as a feeding-stuff appeared in this *Journal*, December, 1909, p. 735.

the report by H.M. Commercial Attaché at Yokohama (Mr. E. F. Crowe) on the trade of Japan in 1909 (*F.O. Report, Annual Series, No.* 4511).

The import of manures into Japan in 1909 forms one of the most interesting items in the Customs Returns. Bean cake heads the list as regards value; the total amount imported in 1909 was 575,180 tons, valued at £2,283,700, or an average of £3 19*s.* 4*d.* a ton, as compared with 461,950 tons, valued at £2,220,000, in 1908, or £4 16*s.* 1*d.* a ton. Next comes sulphate of ammonia; in this item there was a big decline from 66,445 tons, valued at £898,000, to 45,835 tons, valued at £604,700, while in the case of both rock phosphate and fish guano there was a decrease of over £100,000. The imports of nitrate of soda increased slightly.

It is a well-known fact that bean cake has for years occupied the position of the most popular imported fertiliser in Japan. Now, however, that the United Kingdom, and the Continent of Europe and America to a less extent, have become purchasers of Manchurian beans, the question arises as to whether Japan will be able to continue to buy bean cake in huge quantities if the price rises appreciably. In studying this question two factors should not be lost sight of; one is that Japan is herself a large grower of soy beans, having, according to the latest available returns (1908) over 1,200,000 acres under cultivation, producing annually some 19,000,000 bushels of beans, while the other is that Japan imports very large quantities of soy beans from China and Corea. The greater part of these beans is used for the purpose of human food, *i.e.,* in the making of "soy," "miso," and bean curd, but a part, by no means small, is used as a fertiliser.

Both in the case of beans and of cake, the imports in 1909 were above those of the previous nine years, but the average price was the lowest since 1903. Should the price in future be forced up very high in consequence of British and other demands, the presumption is that Japan would turn to sulphate of ammonia, if the cost per unit of nitrogen therein were less than in the bean cake. On the other hand, it must be remembered that the removal of the import duty on sulphate of ammonia in the United States of America means that the United States will probably absorb large quantities of the British output, and that Japan will have to pay a higher price if she wants a share of this fertiliser. Thus the outlook for nitrate of soda becomes a good deal brighter, and now that, owing to the subsidised Japanese line to South America, it is possible to get cheap direct rates of freight, it looks as though nitrate of soda will be a serious competitor to the other nitrogenous fertilisers, except in the matter of wet rice cultivation.

There is a point which, though obvious enough to those intimately connected with the trade, is sometimes overlooked in general discussions on the subject of bean cake, viz., that the British farmer can afford to pay a proportionately higher price for cake than the Japanese farmer, the reason being that in the United Kingdom the cake, after serving for cattle feeding, turns into a fertiliser, whereas in Japan it is employed as a fertiliser directly, without any intermediate use.

Grain Trade of Roumania.—The Foreign Office Report (*Annual*

Series, No. 4445) on the trade of Roumania for 1909, in addition to a report on the harvest, gives a review of the grain market, the grain freights, and other particulars as to the grain trade of Braila, Constantza, Galatz, and Sulina.

Butter-making in Holland.—H.M. Consul at Amsterdam (Mr. W. A. Churchill), in his Report for 1909 (*F.O. Reports, Annual Series, No.* 4415), states that the churns employed in butter-making in that district are principally of the Holstein pattern, consisting of a slightly conical vat, suspended between iron supports, in which a vertical spindle is made to revolve. Butter-making by individuals is rapidly disappearing and large steam dairies are gradually being substituted. In these steam dairies an American pattern of churn is coming into use, consisting of a horizontal cylindrical vat, which is supplied with one or two sets of rollers to work the butter in the churn. The use of the large horizontal American churns, in which quantities up to 2,600 pints of cream can be churned in one operation, has greatly facilitated and expedited the manufacture of butter. With the old Holstein pattern of churns mentioned above no more than 350 to 500 pints could be worked in one operation.

A Milk Preserving Machine.—The Board are informed by the Foreign Office that a machine was exhibited at the Bordeaux Agricultural Show in May, 1910, for preserving milk by a novel process. The fluid is treated at a very high pressure, and, after being pasteurised, will keep for an indefinite length of time. A sample was exhibited which was said to have been fifteen months in bottle, and remained perfectly sweet uncorked for several days in thundery weather. The treatment to which it is subjected crushes the fatty globules and mixes them so closely with the watery components of the milk that they cannot again be separated; cream cannot therefore be obtained, but the preservative qualities obtained by the method may make it useful for purposes of storage on long voyages. The machine was patented about three years ago.

Report on Wheat Cultivation in Persia.—The Board have received through the Foreign Office a report on wheat cultivation in Dashtistan and Behbehan, districts bordering the Persian Gulf, which may be seen by persons interested, at the Offices of the Board, 8 Whitehall Place, S.W.

Estimated Export of Crops from Palestine.—The Board have received through the Foreign Office a Report, dated June 17th, from H.M. Consul-General at Beirut, Palestine, on the state of the crops and agriculture of the district.

Haiffa-Acre.—According to an experienced merchant the following is the average amount of the annual export of the following articles:—Beans, 2/3,000 tons; lentils, 1,000 tons; dariseed, 4/5,000 tons; caroubs, 1/1,500 tons; peas, 5/6,000 tons; vetches, 5/600 tons; sesame seed, 6/7,000 tons; bones, 2/300 tons; wheat, 20/25,000 tons; barley, 2/3,000 tons. With the exception of beans, of which the crop is said to be this year defective (about 1/1,500 tons only), the other articles of produce promise a good yield, superior, at all events, to that of 1909.

Tyre-Sidon.—The crops in general promise to be good in the districts of Tyre and Sidon, and may, indeed, be considered as fairly

assured now. The wheat crop is estimated to be about 50 per cent. more than in 1909. It is expected that there will be 3/4,000 tons of wheat, and 3/4,000 tons of barley for exportation. As regards beans, lentils, vetches, and fenugreek, the yield is expected to exceed that of last year, by 10 to 15 per cent. Estimated quantity available for export:—Beans, 3/5,000 tons; lentils, 3/4,000 tons; fenugreek, 2/2,500 tons; vetches, 1,500 tons. As regards peas and dariseed, no quantitative estimation can be made yet, but the weather conditions have, up to the last, been favourable. In any case, there will be a few thousand tons available for export, especially peas. The locust-bean crop is said to be also good, and up to 1,500 tons might be exported.

Beirut.—Beirut is specially interested in districts from which the principal articles of export are wool and cereals. The average amount of exported wool is about 2,000 tons of unwashed wool. Thanks to the frequent and timely spring rains the sheep have been well fed, and the next wool crop is expected to be superior to that of last year, in regard to both quality and quantity. As regards barley, the forthcoming crop is expected to be much larger than that of last year, which was defective. While last year the total exported quantity was about 12,000 tons, the amount this year is expected to be at least 25,000 tons. Reports about the Hauran crop are very satisfactory, and the estimated quantity of export is put by some at even 50,000 tons.

At all events, a percentage varying from 10 to 20 per cent. in excess of 1909 may be reckoned upon in the grain exports.

Tripoli.—As a port of exportation, Tripoli is still unimportant, as the bulk of the export products of the district is brought to Beirut by rail. Still, there will always be a few thousand bags of beans, peas, barley, &c., and in any case this small export will, it is expected, exceed that of 1909 by 15 to 20 per cent. There will be a few thousand quarters of beans and some peas from Tartous, a dependency of Tripoli.

Lattakia.—The cereal crops at Lattakia are expected to be better than last year, and 20/25,000 tons of wheat and barley are expected to be available for exportation. The bean export is estimated at 10/12,000 quarters. As to the products of later sowings, such as peas, dariseed, vetches, sesame seed, and oats, the yield in the case of each of these products promises to be above that of last year. Peas and dariseed are more extensively cultivated than the rest, and the estimated quantity of dariseed for export is 15/20,000 quarters. Lupin and oat crops are estimated at 1,500/2,000 tons.

Pure Bred Live Stock in Argentina.—Some interesting information as to the number of pedigree stock of British breeds entered in the Argentine Breed Registers is given in a note in *The Review of the River Plate* (April 1, 1910), from which it appears that the Argentine Herd Book was commenced in 1888, and since 1891 has been under the control of the Sociedad Rural Argentina. In 1901 the animals entered comprised 5,965 cows and 4,815 bulls. Since that date the numbers have rapidly increased, and at the end of February, 1910, appear to have amounted to 34,191 cows and 29,077 bulls. The most important breeds are the Shorthorn and Hereford.

The figures for the different breeds are stated to be as follows :—

	Cows.	Bulls.
Shorthorns	25,146	22,117
Hereford	6,939	5,192
Aberdeen Angus	1,899	1,633
Red Shorthorn	161	102
Red Polled	44	31

As regards sheep the figures show that at the end of December, 1909, 12,760 ewes and 9,298 rams were entered in the Argentine Flock Book, no less than 11,410 ewes and 8,768 rams being Lincolns. The other breeds mentioned are the Shropshire, Romney Marsh, Leicester, Hampshire, and Oxford, which together account for 1,350 ewes and 530 rams.

The Argentine Equine Stud Book only dates from the beginning of 1909, and contains three classes of horses, viz., those imported, Argentine born (Definite Register), and Argentine born (Preparatory Register). Fifteen breeds are mentioned, and the totals in the three classes are :—

Imported	1,596
Argentine born (Definite Register)	1,966
Argentine born (Preparatory Register)	8,484
Total	12,046

Of these the breeds chiefly represented are as follows :—

	Imported	Argentine born (Definite Register).	Argentine born (Preparatory Regist r).
Clydesdale	338	500	2461
Shire	300	171	1838
Percheron	489	356	2403
Hackney	268	799	696
Yorkshire	41	25	361
Suffolk Punch	23	6	303

It will be observed that the Percheron is competing closely with the Clydesdale and Shire, coming, indeed, a close second to the former of these British breeds, the respective totals being :—Clydesdales, 3,299; Percherons, 3,248; and Shires, 2,309.

Small Holdings in Greece.—The report on the trade and agriculture of the Piræus and district in 1909 (Foreign Office Report, Annual Series, No. 4,484) by the British Consul, Mr. Errol MacDonell, contains some account of a large area (37,000 acres) farmed on a system of small holdings by the Lake Copais Company.

The company's land is in great part let out to peasants from the surrounding villages in small holdings of from 5 to 100 acres, a rent charge of 20 per cent. of the actual yield of produce being made for the use of the land. To facilitate the verification and collection of rents the tenants are obliged to bring the produce to the proper district threshing floor, and to have it threshed by the company's threshing machines at a fixed charge. For this purpose nine sets of British steam-driven threshing machinery are owned by the company.

Some improvement is already noticeable in the methods of farming

carried on by the company's tenants. Steps have been taken by the company to enforce more careful cleaning of the land, improved tillage and the introduction of a rotation of crops where practicable, and the use of selected and clean seed.

In addition to 2,000 tenants who possess small holdings on lease from the company, an area of 4,200 acres is farmed on the co-operative system by 232 peasant families. These are mostly of the poorer class, who possess neither working animals nor the necessary seed, and who, in return for their labour at clearing the ground—hoeing and reaping—receive a fixed share of the produce of the crop.

The company has always found a keen demand for all land suitable for cultivation, and no difficulty has ever been experienced in finding cultivating tenants. Emigration, which has depleted the male population of so many village communities in Greece, has as yet hardly been felt in the neighbourhood of the Copais, but there are signs that the movement has commenced in that region.

About 20,000 acres, chiefly land still unfit for cropping, were reserved for grazing during the year. The number of head of live-stock grazed at fixed rates was as follows:—Sheep and goats, 66,409; horses, 2,865; cattle, 1,431; pigs, 2,822; turkeys, 4,611.

Cattle, pig, and sheep farming is carried on by the company. Good results have been got from the use of imported British pigs for crossing and improving the native breed of swine. A further consignment of six pigs of the Tamworth breed has recently been imported.

Dried Beetroot Pulp as a Feeding Stuff in France.—The Foreign Office Report on the trade of Calais in 1909 (*Annual Series, No.* 4,491) contains the following note:—

As the subject of beetroot cultivation and sugar production is now attracting attention in the United Kingdom, it may be of interest to note that the pulp of the beets, after extraction of a large proportion of the saccharine juice, is largely used in this district as cattle food.

A beet-drying company near Ardres is reported to be producing a new and marketable article of beetroot dried by an improved mechanical process, the product, saleable at about 8*s.* per cwt., being described as rich and wholesome, containing 60 to 62 per cent. of sugar, suitable as food for cattle, and specially good for horses. The total production in 1908 was estimated at about 500 tons, approximate value £4,000, all consumed in France. Figures for 1909 are not to hand, but it is suggested that the production may be quintupled, the mechanical plant of the company being transformed and largely increased.

It is expected that this new industry will permit of the cultivation of larger areas of beet, and the product may partially replace the enormous quantity of cattle food hitherto imported from foreign countries. It is also suggested that the dried beet pulp should be exported to the United Kingdom.

Hops in the United States.—In a report on the trade of the Consular District of Portland, Oregon, in 1909 (*Foreign Office Reports, Annual Series, No.* 4506), Mr. Consul Laidlaw gives some information on the hop trade in the States of Oregon and Washington, one of the most important hop districts of the United States.

The year 1909 opened with considerable stocks of old hops in first

hands and with prices as low as $2\frac{3}{4}d.$ per lb. Deliveries during January and February were considerable, and some contracts were made with growers for new hops at $5d.$, spot hops advancing slowly to $3\frac{3}{4}d.$ at the end of April, when stocks in Oregon and Washington were about 21,600 bales (35,678 cwt.) of all growths.

Bad weather in May was reported to have killed off many roots, and the crop of Oregon was estimated at 62,500 bales (103,237 cwt.) and prices advanced. At this time many yards which had been neglected on account of poor prospects were sprayed and put in order as much as possible. In July purchases were made even of 1907 growths at $4d.$ to $4\frac{1}{4}d.$ Fine showers in July raised the estimates to 80,000 bales. Prices advanced rapidly owing to reports of short European crops, and $7d.$ was readily paid for 1908 hops, while offers of contracts were made at $10d.$ and over for new crop. In September $8\frac{1}{2}d.$ was paid for old hops, and in October new crop was selling at $1s.\ 0\frac{1}{2}d.$, but, as a large percentage of the growers had contracted at $5d.$, the resulting profit was reaped by dealers. At the close of the year the market was lower, good hops selling at $11d.$ Stocks in growers hands in Oregon were 15,350 bales, and in Washington 1,200 bales, or about 27,337 cwt. in all in this district. The crop of 1909 was about 82,488 bales (136,223 cwt.) in Oregon, and 17,387 bales (28,719 cwt.) in Washington, as nearly as can be ascertained.

Wool and Dairy Prospects in New Zealand.—The Imperial Trade Correspondent at Dunedin (Mr. W. T. Monkman) reports that, as a consequence of an unusually dry summer, there is likely to be a shortage of feed throughout Otago and Southland, and the wintering of stock has become a serious question. This points to a smaller wool-clip than last season, and the dairying industry also will be affected to some extent. The latter industry, however, is a rapidly expanding one, and its prospects are highly satisfactory.—(*Board of Trade Journal, June* 30*th*, 1910.)

The Central Agricultural Society of the Orange River Colony.—The *Government Gazette* of May 30th of the Orange River Colony publishes the articles of association of the Central Agricultural Society of the Colony. The office of the Society is to be at Bloemfontein.

Among the objects of the Society are the following :—

1. To promote the improvement and rearing of good breeds of general farm stock, the importation of thoroughbred stock into the Colony, and the cultivation and growth of cereals and other crops suitable to the country.

2. To induce flock-masters and others to use the greatest care in the preparation of their staples for sale and exportation.

3. To improve the existing methods of farming by encouraging the introduction of labour-saving machinery, the most improved agricultural implements, and better systems of cultivating the soil.

4. To hold competitive shows and exhibitions of live stock, produce and machinery, and trials of skill in the use of implements and machines applied to farming.

An agricultural exhibition must be held by the Society at Bloemfontein at least once every year.—(*Board of Trade Journal, June* 30*th*, 1910.)

Notes on the Weather in July.

In the *first* week the weather was rainy over the country generally during the earlier days, but the conditions then improved. Temperature was below the average, warmth being classed as "very deficient" in England N.E., E., S.E., and the Midland Counties, and "deficient" elsewhere. Sunshine was less than the normal in almost all parts of England.

During the greater part of the *second* week the weather was dry, but in the south and east of England the sky was often very cloudy. Very little rain fell, except in thunderstorms, on the southern and south-eastern coasts. The temperature was again below the average in England, except in the north-west, but sunshine varied. In the south, south-east, and east of England there was a great deficiency.

During the *third* week unsettled weather was experienced, rain falling on most days over nearly the whole of Great Britain. Warmth was "deficient" everywhere except in England E., where it was "moderate," and sunshine was "scanty" or "very scanty" in almost all districts.

In the *fourth* week cool and unsettled conditions continued till nearly the end of the week, when a decided improvement took place, and the weather became fairer and more seasonable than for some time past. Rainfall was "moderate" in most districts of England, but was "very heavy" in Scotland and England N.W., and "heavy" in England S.W. Temperature remained below the average taking the week as a whole, and sunshine was "scanty" or "very scanty" in all districts of Great Britain.

Report on Crop Prospects on August 1st.

The Crop Estimators of the Board, in reporting on the state of the crops and the agricultural conditions on the 1st August, indicate that the wet and cold weather which prevailed generally during July in the southern part of the Kingdom has been unfavourable to the cereals, but the changes on the month in the prospects of these crops are, for the country as a whole, slight, except in the case of oats. As in the previous month, much diversity is evident in the prospects of different districts.

Wheat and Barley are still expected to prove a little over average in quantity. Speaking generally, the prospects of both have deteriorated in the south and east, and improved in the north and in Wales.

Oats have suffered generally from the July weather, and are now considered as hardly up to the average, the decline in this crop having been fairly distributed over the country.

Peas are scarcely as promising as a month ago and will probably not exceed an average crop. Beans are practically unchanged; and are expected to yield a little over the average. Mangolds are also reported unchanged, while turnips and swedes are, very generally, healthy and vigorous, though mostly backward.

Potatoes have improved considerably during the month, and now appear to be relatively the most promising of all the crops; little disease is reported.

Hay is generally abundant, except in Scotland. Seeds hay appears

to have been secured in better order than meadow hay, a fine fortnight during July in the more northern districts having been particularly opportune.

Hops have not maintained their promise of a month ago, the depreciation being most marked in Kent. The cold weather checked growth, and washing has become more general. The present promise is for a crop slightly over average.

Crops of orchard fruit are reported short everywhere.

The supply of labour is, as a rule, quite equal to the demand, but in a few districts a scarcity of men for temporary labour is mentioned.

Cattle and sheep are generally progressing well, though the latter have felt the effects of the wet and cold season, more particularly in some eastern and south-eastern counties. Warmer weather would be welcome for the stock. Pastures are reported full of keep.

Summarising the reports, and representing an average crop by 100, the appearance of the crops on the 1st August indicates yields for Great Britain as a whole, which may be represented by the following percentages:—Wheat, 101; Barley, 102; Oats, 99; Beans, 102; Peas, 100; Potatoes, 106; Mangold, 102; "Seeds" Hay, 105; Meadow Hay, 105; Hops, 102.

Crop Information published by the International Agricultural Institute.

The Bulletin of Agricultural Statistics, published by the Institute, gives from month to month such information as is available as to the area and condition of the crops in different countries of the world, but it has not been found possible up to the present to reduce the data furnished by the different countries to a uniform basis, and thus enable a summary to be given indicative of the world's crop.

According, however, to the Bulletin for July, the Institute will, in future, use every endeavour to establish monthly, for each product included in the Statistical Service of the Institute, an *average condition figure* for the total crop of all adhering countries—or at least for the majority of such—and to present comparisons with the previous month or with the same month of the previous year.

The Institute will also endeavour to publish, shortly before the time of harvest, an approximate estimate of the probable total production of all the adhering countries; and immediately after the harvest, an approximate statement of the total yield. A comparison of these figures with the total area cultivated will give the probable or actual *average yield* per unit of area for all adhering countries, which will serve as a basis for useful comparisons with preceding years.

It is remarked that if the Institute succeeds in executing this programme, the "Bulletin of Agricultural Statistics," will become a useful and valuable publication, and will greatly contribute to the elimination of that uncertainty which prevails on the different world's markets as to the probable supply of agricultural products, and will aid in the suppression of the resulting fluctuations in prices; thus furthering materially the interests of both producers and consumers.

The same issue of the Bulletin contains a Calendar showing the periods of sowing and harvesting wheat in different countries.

Notes on Crop Prospects Abroad. The following information has been published by the International Institute of Agriculture, Rome, in the Bulletin of Agricultural Statistics for July (No. 7), and shows the average condition of the crops on or about July 1st.

WINTER CEREALS (100 = average condition).

Country.	Wheat.	Rye.	Barley.	Oats.
Austria *	1·9 [1]	2·2 [1]	2·6 [1]	2·8 [1]
Bulgaria	120	120	120	—
Canada [2]	85·5 [2]	88 [2]	—	—
Germany †	2·3 [1]	2·5 [1]	—	—
Holland †	100	102	—	—
Hungary	121·8	112·4	—	—
Croatia and Slavonia...	100	110	—	—
Great Britain	101	—	—	—
Luxemburg	101	105	99	—
Sweden	108–110	—	—	—
Switzerland	94	99	101	—
Tunis	105	—	100	120
United States	100·2	96·8	—	—

SPRING CEREALS (100 = average condition).

Country.	Wheat.	Barley.	Oats.	Maize.
Austria *	—	—	—	2·2
Bulgaria	120	120	—	120
Canada [2]	82·2	86·9	86·3	—
Germany † [1]	2·6	2·6	2·7	—
Great Britain	—	101	100	—
Holland †	—	95	90	—
Hungary	—	108·3	95·7	—
Croatia and Slavonia ...	—	120	120	100
Luxemburg	108	98	100	—
Sweden	—	103—106	104—108	—
Switzerland	95	108	92	90
Tunis	—	—	—	100
United States	70·7	83·7	94·9	100·4

* 15th June. † 15th July. [1] Scale: 1 = very good; 2 = good; 3 = average; 4 = poor; 5 = very poor. [2] Percentages of a standard condition.

APPROXIMATE ESTIMATE OF PROBABLE YIELD OF WINTER CEREALS.

Country.	Wheat.	Rye.	Barley.	Oats.
	cwt.	cwt.	cwt.	cwt.
Bulgaria	27,900,000	5,300,000	4,500,000	—
Hungary	107,900,000	31,600,000	—	—
Italy	99,100,000	2,700,000	4,200,000	7,200,000
Japan	11,100,000	—	35,200,000	—
Luxemburg	—	—	—	—
Roumania	70,000,000	—	—	—
Tunis	2,950,000	—	2,900,000	1,540,000

The following supplementary notes are given :—

Bulgaria.—In several districts flood and hail have done some damage and the crops are slightly lodged. The quality of the winter cereal crops may be stated as fairly good. The damage caused by rust, field mice, and locusts is, in general, of small importance.

Germany.—In the north exceptionally warm weather and drought had a destructive effect on the crops during the latter part of May and the first half of June. Towards June 24th the temperature diminished and rain fell. In the south the heat has not affected the crops, but rain has been too abundant, and damage is feared from the excessive moisture. Generally speaking, the condition of winter wheat is still good; reports on winter rye are also favourable, and a good harvest may be expected. The yield of winter rye is estimated at 98·5 per cent. of a normal harvest. The condition of spring crops leaves much to be desired in several districts, rain having fallen too late. Complaints have also been made as to weeds, and the presence of the frit fly is reported.

Hungary (July 12th).—Towards the end of June and during the early part of July the weather was wet and stormy, and the crops have especially suffered from the hail. The excess of moisture has delayed the harvest in many districts, and the quality of the grain has deteriorated in several parts of the country. In spite of the bad weather, harvesting is now completed almost everywhere, with the exception of the mountain districts. The results of several trial threshings fully correspond to, and in several cases have even exceeded, the expected yield. The present aspect of wheat promises a good harvest. The results for rye to date are somewhat inferior to previous estimates. Barley is poor, and falls short of expectations both in quantity and quality. Oats have improved under favourable weather conditions. Maize shows excellent development.

Croatia and Slavonia.—Complaints have been received as to damage caused to wheat by rust, mice, and Hessian fly, and rye has suffered from rust and blight. Contrary to the conditions existing in Hungary, oats are in excellent condition, maize has suffered from an excess of moisture, but if the rain ceases, a good harvest may be expected.

Italy.—Though the winter was relatively mild, bad weather prevailed continually during the spring, both in the islands and on the mainland. The temperature was very changeable, and rain and snow fell, damaging the rye in the Piedmont mountains. Cereals have been lodged by wind and storms in many districts. An abundance of moisture favoured vegetation, but has also considerably increased weeds, insects, and cryptogamic diseases. Rust has attacked wheat everywhere, while in Calabria the Hessian fly, and in the Latium valleys, the *Ophiobolus graminis* have also caused considerable damage to the wheat crop. Maize, on the contrary, promises an excellent harvest both as regards quantity and quality. Slight damage has been caused to the crop in Benevento, but it is of no great consequence.

Luxemburg.—The warm weather which prevailed during the first half of June greatly favoured the development of the crops, but three weeks of rain which followed have somewhat diminished the good outlook. The aspect of the winter crops is on the whole good. Spring crops, with the exception of rye, have improved since last month.

Russia.—A sudden fall in temperature about the end of May (new

style), followed immediately by serious drought and exceptionally warm weather after June 2nd, have had an unfavourable influence on the conditions of all cereal crops, both winter and spring varieties having considerably depreciated.

In the immense expanse of country embracing the whole of Central Russia and the greater part of Russia in Europe, with the western boundary on a line drawn through Novetchercask, Koursk, Kalouga, Moscow, and Vologda, where, towards May 23rd, autumn crops gave hopes of a very good harvest, conditions have somewhat fallen. This depreciation has been caused in the provinces of the Black Soil Belt by drought, while in the other provinces severe morning frosts, in addition to drought, have done considerable damage to rye during the period of heading. However, the excellent development of the autumn crops during the spring has helped to counterbalance the injurious effect of later unfavourable circumstances, and the aspect is now not so bad as might be feared. In short, conditions which were stated as good at the middle of May may now be regarded as satisfactory; with the exception of Southern Russia, where the condition of autumn crops remains very good. In other parts of Russia, no appreciable changes have occurred since the last period.

Spring crops were the chief victims of the drought and hot weather during the latter half of May and the first half of June. Although in the greater part of the country they germinated uniformly well, development was slow. The provinces principally affected were Poltava, Tchernigow, nearly all the provinces of West Russia, and Lithuania. Spring crops have also suffered considerably on account of lack of moisture throughout the rest of the Empire, and especially in that part of the country outside the Black Soil Belt, where the development of the spring crops depended entirely on the early advent of rain, which eventually fell towards the 20th June over a considerable area of Russia in Europe, confirming the hopes of a general improvement in the condition of spring crops.

Sweden.—The severe drought which prevailed from June 1st to 28th has delayed the development of the spring crops; however, since the latter date rain has fallen, and barley and oats have benefited from the moisture.

Switzerland.—Considerable damage has been done by the excess of rain during the last few weeks, and crops have been lodged. Some rust is reported almost everywhere. Oats have been damaged by the *Oscinia vastator.* Maize has deteriorated on account of excess of moisture.

Canada.—Precipitation was light except in the maritime provinces. Manitoba and Southern Alberta are suffering from drought and heat. Conditions in the Prairie Section, middle and north, are only slightly below normal. Recent rains have improved prospects everywhere.

Argentina.—Meteorological conditions were fair at the time of sowing, and 40 per cent. of the sowing was completed by July 1st. The season is late as compared with last year.

New Zealand.—Meteorological conditions were favourable during the period of sowing; 75 per cent. of the work of sowing was completed by July 1st. The season is one month earlier than in 1909.

Russia.—According to a despatch from Mr. H. Cooke, Commercial Attaché at St. Petersburg, the official Commercial and Industrial Gazette of July 2/15 states that the grain crop prospects are in general above the average. Winter grain, however, promises a better yield than spring. Winter wheat promises to be considerably above the average. It is good or satisfactory almost everywhere, an unsatisfactory crop being expected in rare cases only. Spring wheat is good in the principal regions of production, but is unsatisfactory, and in places bad, in most of the north-western governments, in Tchernigoff, Poltava, the south of Saratoff, and the neighbouring districts of the Don territory. In general, spring wheat promises to be above average. Oats suffered more than other grain from drought and cold in May, but the condition of the crop is average, or even a little above average. The barley crop also promises to be above the average. It is good in the chief regions of cultivation, and in some other districts. A later telegraphic report, of July 1/14, confirms these general indications, but states that there is some deterioration in the south-eastern regions, and some improvement in the north-eastern region with respect to both spring and winter cereals.

Mr. J. P. Bagge, British Vice-Consul at Nicolaiev, reported on July 5th that in the district supplying that port winter wheat was very good. Harvesting had then begun. Spring wheat, which occupies three-quarters of the total wheat area, had been damaged by heat, and on the whole the harvest was not expected to be above the average. With an average harvest, however, and a large stock of grain from last year's harvest left in the country, a brisk export was expected.

Germany.—According to the report of the Imperial Statistical Bureau relating to the middle of July, the condition of the crops was as follows:—Winter wheat, 2·3; spring wheat, 2·6; winter rye, 2·5; spring rye, 2·6; barley, 2·6; oats, 2·7; potatoes, 2·5 (1 = very good; 2 = good; 3 = medium (average); 4 = small). The month showed a great change from the hot, dry weather of the previous month. Frequent rain was experienced for three weeks, accompanied by low temperature, and in places heavy thunderstorms. Great damage was caused by floods in west and south Germany, and weeds and insect pests were encouraged by the moist conditions. The prospects for the winter grain crops, however, were favourable, and winter wheat was distinctly above the ten-year average. Spring cereals were helped by the rain, but this was hardly in time to make up for the previous drought, and the prospects were hardly as good as in the previous month. Potatoes showed good growth, but were beginning to suffer from excess of moisture, while diseases of the haulm and tubers were becoming rather widespread.

Hungary.—The report of the Ministry of Agriculture in the middle of July estimates the yield of the principal crops, except in the case of oats, at a rather lower figure than in the previous month. The favourable expectations of the wheat harvest which were entertained have been lowered by the excess of rain and the low temperature, especially in the districts where the condition of the crop was most promising.

Fruit Crops in Holland.—Mr. Henry Turing, the British Consul at Rotterdam, states that the review of the Ministry of Agriculture, for July, gives bad accounts of the coming crops of apples and pears, which

in some parts of the country are likely to prove a failure, and in others unsatisfactory. Plums are good only in the district of Bangert; elsewhere they are very poor.

Bulgaria.—H.M. Minister at Sofia, in a despatch dated July 21st, states that although the grain crops have been partially destroyed in some districts by floods and hail-storms, the outlook, taking the country as a whole, is decidedly more favourable than usual. It is anticipated that the yield will be 35 per cent. higher than that of last year.

United States.—The Crop Reporting Board of the Department of Agriculture give the condition of maize on August 1st as 79·3, compared with 85·4 last month, 84·4 on August 1st, 1909, and a ten-year average of 82·1. Preliminary returns indicate a winter wheat crop of about 458,294,000 bushels, or an average of 15·8 bushels per acre, as compared with 15·5 bushels last year. Spring wheat was returned at 61·0, as compared with 61·6 last month, 91·6 on August 1st, 1909, and a ten-year average of 81·9. The average condition of the other crops was as follows:—Oats, 81·5; barley, 70·0; potatoes, 87·9; the ten-year averages for these crops being respectively 82·6, 85·3, and 86·0.—(*Dornbusch,* August 8th.)

Agricultural Labour in England during July.

The Board of Agriculture and Fisheries have been furnished by the Board of Trade with the following report, based on returns from correspondents in various districts, on the demand for agricultural labour in July.

The hay harvest was considerably hindered by rain in July, and, though many men found employment at hoeing when the weather was unsuitable for haymaking, some time was lost by day labourers in most parts of the country. The demand for such men was generally good, and the supply sufficient.

Northern Counties.—Employment was generally regular in these counties, though a few day labourers employed at haymaking lost time through rain towards the end of the month. There was a good demand for these men in most districts, which was met by about an equal supply.

Midland Counties.—Employment on the whole was good. Haymakers lost time occasionally through the wet weather, but a number of men at such times found employment at hoeing. The supply of and demand for day labourers were usually about equal. A scarcity of men for milking was reported in the Uttoxeter and Lichfield Union (*Staffordshire*). Some scarcity of men for permanent situations was also reported in the Evesham (*Worcestershire*) and Stratford (*Warwickshire*) Unions.

Eastern Counties.—The hay harvest was considerably prolonged by rain in these counties, but there was a large amount of hoeing to be done among the root crops, and day labourers on the whole were in fairly constant employment. There was a good demand for these men, which was generally met by the supply; in several districts, however, the supply was not sufficient.

Southern and South-Western Counties.—In these counties, as else-

where, some day labourers were in irregular employment on account of wet weather, which hindered the hay harvest. The demand for such men for haymaking, hoeing roots, &c., was fairly good, and but few men (if any) were unable to obtain work when the weather was favourable. Some scarcity of men for permanent situations was reported from certain districts in *Somerset, Herefordshire, Gloucestershire* and *Devon*.

THE CORN MARKETS IN JULY.

C. KAINS-JACKSON.

The wheat markets were already advancing under the influence of unsummerlike weather when the American Bureau Report of July 11th came to hand and supported a strong speculative movement. Considerable scarcity of fine spring wheat is now apprehended, and holders of that type stand out for what, as compared with June quotations, are high prices. Neither barley nor oats are appreciably dearer, and maize is rather in buyers' favour, especially for autumn delivery.

Wheat.—The London average for the week ending July 5th was 31*s*. 11d., and for the week ending 26th was 33*s*. 11*d*. per qr. This advance is a fair measure of price improvement all over the country. In Kent 35*s*.–36*s*. is an average, but in the north 32*s*.–33*s*. is more usual. The sales of home-grown grain at Mark Lane have been good for the time of year. Imported wheat has risen by sixpences till 44*s*. has been reached for the finest produce of the Dominion, and 43*s*. 6*d*. for the best grain from the U.S. States bordering on the Canadian frontier. The belt of wheat-growing land, which has a width of about 200 miles, a hundred on either side of the frontier line, now produces the grain for which top prices are permanently obtainable. This wheat has unique merit for producing a showy loaf. Russia has large areas capable of growing wheat, almost, if not quite, as rich in dry gluten, but Russian shipments are, on the average, far from clean, and there is not the trustworthy grading which has done so much to secure a steady market for Canadian and American produce. Other sorts of imported wheat closed July at from 38*s*. to 42*s*. per qr.; Argentine, Indian white, and Australian made 39*s*. to 40*s*.; Durum and Indian red, 38*s*. to 38*s*. 6*d*. per qr. The price of new American winter wheat for August shipment to London was 7*s*. 6*d*. to 7*s*. 7*d*. per cental (36*s*. to 36*s*. 6*d*. per 480 lb).

Shipments for July were 428,000 qrs. from North America; 552,000 qrs. from South America; 2,130,000 qrs. from Russia; 224,000 qrs. from Europe S.E.; 874,000 qrs. from India; and 169,000 qrs. from Australasia. The Russian and Indian shipments were in excess of anticipations; those from the other countries somewhat less than usual. Owing to the grave reduction in crop prospects in North America, the idea that the approaching cereal year will have a large wheat surplus is no longer entertained. Market opinion, however, is unanimous that very fine, possibly record, crops have been secured in Austria-Hungary, in Roumania, and in Europe S.E. generally. The wheat supply on passage has fallen on the month from 2,900,000 qrs. to 2,550,000 qrs. Of this,

less than 200,000 qrs. is hard spring wheat, so that the exceptional prices made for that particular type as July closed are easily explained.

Flour.—The London top-price has been raised to 35*s.*, a florin advance on the month, in close correspondence with the florin rise in British wheat from the 5th to 26th at Mark Lane. Household flour is 3*s.* dearer, 29*s.* 6*d.* being paid, where a month before 26*s.* 6*d.* had been quoted. London bakers on the 18th put bread up a halfpenny per quartern loaf, but prices in the country are very irregular. There is so little foreign flour on passage that most spot-holders are able to ask an important advance: 33*s.* 6*d.* for finest Manitoba, 28*s.* for Iron Duke. Owing to the contracts for autumn shipment, however, Hungarian is not dearer. The North American shipments for July were only 226,000 sacks, the smallest monthly exportation for a very considerable period.

Barley.—Most markets seem to expect about an average home crop, and there are hopes of better quality than last year. A satisfactory crop is reported to London agents from the famed malting barley districts of Bavaria, Bohemia, and Moravia, also from the Ouchak barley regions of Anatolia. Less satisfactory reports from France, Bulgaria, and California have reached Mark Lane, and made the holders of stock in granary firm. Light Russian barley has been the only sort in much sale during July. It has made 19*s.* to 20*s.* per qr. Russia's shipments for the export year ended July 31st were 19,870,000 qrs., against 17,299,000 qrs. in the previous season. An average exportation is about fifteen millions. During July 1,525,000 qrs. were shipped by Russia, 150,000 by Europe S.E., and 42,000 by California. The quantity on passage on the last day of the month was 200,000 qrs. only.

Oats.—The oats of 1909 growth, seasoned, dry, and fit for horses, have of late been cheap at 18*s.* to 19*s.* in the shires. London, which attracts the pick of the oats, has been paying 19*s.* to 20*s.* for 312 lb. lots, 21*s.* to 22*s.* for 336 lb. kinds. Foreign oats have not been a brisk sale; 14*s.* to 14*s.* 6*d.* for Argentine, 15*s.* to 15*s.* 6*d.* for Baltic, 16*s.* to 16*s.* 6*d.* for White Sea have been about the prices required by importers. Shipments for the month were 151,000 qrs. from North America, 177,000 from South America, 529,000 from Russia, and 34,000 from Europe S.E. The quantity on passage on the last day of the month was 300,000 qrs. Russia during the export year ended July 31st shipped 9,628,000 qrs., against 6,018,000 qrs. in the previous twelve months. About five million quarters constitute an average exportation.

Maize.—The prospect of abundant supplies in 1911 appears to be accepted by the markets as one that only a combination of remarkable weather accidents can falsify. But the expectation of large arrivals in the last four months of 1910 is slight, and the trade is depending almost exclusively on a single shipper, Argentina. It is impossible to say what prices are likely to rule between now and the time when the crops to be secured in October get into motion. The use of maize in this country is always large, and since January 1st we are, as compared with last season, a clear million quarters short in our supply. At 25*s.* per qr. it cannot be said that maize is dear, so that the non-speculative buyer will probably take the opportunity to build up his stock at this price. There are 900,000 qrs. on passage, which should furnish a liberal supply in a few weeks. July shipments were 83,000 qrs. from

North America, 1,749,000 qrs. from South America, 159,000 qrs. from Russia, and 485,000 qrs. from Europe S.E.

Oilseeds.—The British markets of London and Hull, which are the centres of the trade in oilseeds, are concerned for future supply. India has better yields than in 1909, and Argentina adds yearly to the area under linseed. Nevertheless, the demand for actual use appears steadily to be forging ahead of production. The exchanges of July were very strong for linseed, and despite free offers of Indian cottonseed, the price of that staple rose also. Egyptian fine cottonseed, obtainable in 1905 for 6*s.* per cwt., had risen by the early months of this year to 9*s.*, and is now at 10*s.* The offers to ship new crop in November at 8*s.* 6*d.* per cwt. promise some relief to this stringency. On the last day of July there were on passage 200,000 qrs. of linseed, 14,000 qrs. of rapeseed, and 39,000 tons of cottonseed. The dearness of oilseeds affects other staples containing oil; thus soy beans are fully 7*s.* 6*d.* per ton dearer on the month.

Oilcake.—Those who early in July bought good linseed cake at £7 17*s.* 6*d.* per ton were able on the 30th to re-sell at £9. Cottonseed cake made £6 5*s.* for London and £6 for Egyptian. Soy bean cake made £6 10*s.* per ton, an advance of 15*s.* from late June.

Various.—Beet sugar continues to command nearly 15*s.* per cwt. for delivery of old make in August, September, and October; but new make, November and December delivery, is 3*s.* under this price. Canary-seed makes 44*s.* per qr., Dari 26*s.* per qr., and Gram 25*s.* per qr. These three articles meet with a very fair sale. Buckwheat at 27*s.* per qr. and rye at 25*s.*, may also be mentioned as articles having a market.

THE LIVE AND DEAD MEAT TRADE IN JULY.

A. T. MATTHEWS.

Fat Cattle.—The markets have been very well supplied with grass-fed cattle, and their condition has been well up to the average for the time of year. While the weekly general average values have been singularly uniform, there have been frequent instances of wide variation in local prices, some markets being much better than others. One of these cases occurred at Newport (Mon.), where, in the last two markets of the month, first quality Shorthorns realised 9*s.* 7*d.* per stone, which was about 7*d.* per stone more than the English average, and 10*d.* more than was obtained at several leading markets, such as Bristol, Lincoln, and Nottingham. This is by no means an isolated case, and it would appear quite possible for some graziers to reap considerable advantage by a closer study of the latest information. The average price of prime Shorthorns for the month in about twenty-one markets was 9*s.* 0½*d.* per stone, second quality 8*s.* 1½*d.*, and cows and bulls 7*s.* 1*d.*, the last mentioned having sold remarkably well. The average for first and second quality Herefords was 9*s.* 5*d.* and 8*s.* 7*d.*, for Devons 9*s.* 2*d.* and 8*s.* 0½*d.*, for Runts 9*s.* and 8*s.* 6*d.*, and for Polled Scots 9*s.* 3*d.* and 8*s.* 10*d.* This shows a decline of 2*d.* on prime Shorthorns, and 2½*d.*

on second quality as compared with the June averages, while first quality Herefords showed an advance of $1\frac{1}{2}d$. The demand continued excellent in nearly all markets, and the slight decline in the average rates is more than accounted for by the less finished condition of the animals.

Veal Calves.—The market for veal calves was steady and featureless, with scarcely any change from week to week in average values. The month's average in twenty-six British markets was $8\frac{1}{4}d$. and $7\frac{1}{4}d$. for first and second quality. Prices were very even throughout England.

Fat Sheep.—There was practically no change in the average value of fat sheep, June prices being just about maintained. The second week showed a weakening tendency, and values receded about $\frac{1}{4}d$. per lb. for all qualities; but there was a recovery the following week, and as the month closed there was a general firmness exhibited which seems to point to a better trade in the autumn. The general averages for the month for English markets were, Downs, $8\frac{1}{4}d.$, $7\frac{1}{4}d.$, and $5\frac{3}{4}d.$, and Longwools, $7\frac{1}{2}d.$, $6\frac{1}{2}d.$, and $5\frac{1}{2}d$. per lb. for first and second quality wethers and fat ewes respectively. It will be seen that there is a difference of 1*d*. per lb. between first and second quality, and as, at this time of year the latter largely predominate, the above figures may seem to some readers rather flattering. It is a fact that many agricultural correspondents complain that sheep are selling badly, and this is explained by the scarcity of choice handy weights, which attract buyers at all times, but especially during summer. It should be recognised that a very large proportion of the sheep now offering are 80 lb. wethers, and these are all classed as second quality. For some time past the price of sheep in Scotland has been relatively higher than they would fetch in England, and so our southern markets have been largely deprived of their usual supplies of small Scotch tegs, which always command good prices in London.

Fat Lambs.—The supplies of lambs have continued large, and prices fell considerably during the month. It is, of course, usual for lamb values to approach more nearly to those of mutton as the season advances. The average prices for July in forty British markets were $9\frac{1}{4}d$. and $8\frac{1}{4}d$. per lb. for first and second quality respectively.

Fat Pigs.—Bacon pigs have steadily advanced in value during the month, which has now recovered the average of March last. In twenty-nine British markets the average price was 7*s*. $11\frac{3}{4}d$. per stone for small, and 7*s*. 4*d*. for heavier pigs. First quality pigs fetched an average of 8*s*. 2*d*. during the last week.

Carcass Beef—British.—Scotch sides were in good request throughout, and in London realised a steady average of $7\frac{1}{2}d$. to 8*d*. per lb. for short, and 7*d*. to $7\frac{1}{4}d$. for long sides. English sides, as shown in the Central Market, were of very moderate quality, and averaged $6\frac{3}{8}d$. to $6\frac{5}{8}d$. per lb.

Port-Killed Beef.—Deptford, popularly known in London as "town-killed" beef, has continued scarce, and realised full prices, slightly exceeding those of English. The average Central Market price for July was $6\frac{3}{4}d$. and $6\frac{1}{2}d$. per lb. for first and second quality.

Chilled Beef.—United States chilled beef remained in very meagre supply. The average price of best hindquarters was $6\frac{3}{4}d$. per lb. and of best forequarters $4\frac{1}{8}d$. Argentine chilled, on the other hand, was ex-

tremely plentiful and very cheap, averaging only $4\frac{5}{8}d.$ per lb. for best hind, and $3d.$ for best forequarters.

Frozen Beef.—"Hard" or frozen beef was procurable in plenty at extremely low rates. Best hindquarters averaged $3\frac{3}{8}d.$, and best forequarters $2\frac{5}{8}d.$ per lb. Considerable numbers of forequarters sold as low as $2\frac{1}{4}d.$ per lb.

Carcass Mutton—Fresh Killed.—There was only a comparatively small quantity of small Scotch mutton on offer. The average price was $7\frac{3}{4}d.$ and $7\frac{1}{2}d.$ per lb. for first and second quality. English was steady throughout at $6\frac{1}{2}d.$ to $7d.$ per lb. Dutch supplies were increasing, and sold at $6\frac{1}{2}d.$ to $6\frac{3}{4}d.$ per lb.

Frozen Mutton.—Supplies were very heavy, and prices remarkably low. The best "Canterbury" never exceeded $3\frac{7}{8}d.$ per lb., and much Australian was sold at $2\frac{5}{8}d.$

Carcass Lamb.—There were fair supplies of Scotch lamb, which generally fetched up to $8\frac{1}{2}d.$ per lb. for prime small weights, but $8d.$ was the extreme value of English. Dutch was worth as much within $\frac{1}{4}d.$ per lb. Prime New Zealand began at $5\frac{5}{8}d.$, but gradually declined to $5d.$ per lb. Much frozen lamb was sold at $4d.$ per lb.

Veal.—Prime English veal again averaged $7d.$ per lb., and Dutch fully as much in London. The trade was sluggish, and very good carcasses were often sold at $6d.$ per lb. A few very choice Dutch occasionally made fancy prices, but these were very exceptional.

Pork.—The small quantity of pork on offer was sold at $6\frac{1}{2}d.$ to $7d.$ per lb. for English and about $\frac{1}{4}d.$ less for Dutch.

THE PROVISION TRADE IN JULY.

HEDLEY STEVENS.

Bacon.—There has been more fluctuation in prices during July than for many months. Singed sides had advanced several shillings by the end of the month, Danish $4s.$–$5s.$, Canadian $2s.$–$3s.$, Irish $3s.$–$4s.$; and although the consumptive demand is still considerably reduced, there is no accumulation of stock, the arrivals being correspondingly small. Arrivals from Canada continue very meagre; those from America have been a little more free, but were mostly composed of hams. American hams showed a rise at all markets, and prices were about $23s.$–$25s.$ per cwt. above those current at the same time last year. Pigs are still very scarce in Canada, but American markets have been receiving freer arrivals. Prices on the month have fluctuated considerably, ranging from \$9.50 to \$7.70, these being 60 cents to one dollar above last year at the same time.

Some small consignments of Australian cured bacon arrived in London during the month, and sold readily at prices near those current for Continental. There are also factories in operation in Russia which are increasing the arrivals from that country. Denmark and Holland are now sending larger consignments to the north of England to replace Canadian and American, so reducing the shipments into London.

American lard has shown a further drop during July of from $4s.$ to

5*s.* per cwt., which brings this product within a shilling of last year's prices. This has been brought about by the small demand, and by hogs arriving heavier than last year, therefore making proportionately more lard.

English and Irish curers report a fair demand, but the difficulty of obtaining sufficient pigs is even more acute. London has been receiving regular consignments of carcases from New Zealand and Australia shipped in refrigerators under the same conditions as sheep, and cured on arrival in this country. On account of the high prices secured the business must be profitable to the producers, feed being very cheap in those countries.

Cheese.—The consumptive demand for Canadian makes during the month has again been disappointingly slow, in spite of prices being reasonable. This is partly accounted for by the large new make in England and Scotland, as in many districts these are being consumed in preference to the former. The unseasonable weather also has helped to decrease the consumption.

Advices from Canada point to the make for the season as likely to be less, and in consequence factorymen are not pushing business, as they think prices will soon show an improvement. There are fair stocks in this country, and importers are timid of increasing their holdings until they get more encouragement from the consuming public, for since the beginning of the season it has been most difficult to make a profit. Importers have not been able to contract as low as they had hoped, 52*s.* c.i.f. being about the lowest contract during the month, and at the time of writing the Canadian advices are decidedly strong, at 1*s.* 6*d.*–2*s.* per cwt. advance on the month.

At the end of the month the estimated stocks of Canadian cheese at the three principal distributing centres (London, Liverpool, and Bristol) were 274,000 boxes, against 216,000 at the same time last year, when both Liverpool and Bristol held considerably fewer cheese. The New Zealand makes are being rapidly cleared, and there are very few more to arrive.

The pasturage conditions in England and Scotland continue satisfactory for a large make, and the trade in these descriptions is good.

Butter.—Throughout the month the demand has been only moderate, and prices show very small changes.

The imports from Siberia continue to increase, and first selections have been readily cleared, but secondary grades have not been in good demand, and parcels are still going into cold stores; pasturage continues good in that country, and the make is very large. More butter is being made in Canada, and small parcels are being exported to England at around 106*s.* c.i.f. The first small shipments of the new season's Australian are now on the way, and the country is reported to be looking well owing to the excellent rainfall. It is anticipated that the shipments from that country during the coming season will create a record. Conditions in New Zealand are also favourable for a large make.

Eggs.—There has been a good consumptive demand throughout the month in spite of the high prices. Quality has been good, but as usual at this time of the year, the demand has been mostly for the best selections.

THE FRUIT TRADE IN JULY.

W. W. GLENNY.

A shortage of fruit amounting to almost famine has been the feature of the past month, retailers reverting to bananas and lemons, simply because their customers could not afford the fancy prices of the hour.

Apples.—Australian and Tasmanian apples in London began at good prices, then settled down on May 10th to about 10*s.* per box of 40 lb., or 3*d.* per lb. wholesale. This continued with slight variation for about eight weeks, when they rose in mid-July to 12*s.* and 13*s.* per box, which is a very high figure. Sturmer pippins are now quoted at 14*s.* to 15*s.* per box. Colonial apples are now over, and a few of home growth are on sale, but they bear evidence of unreadiness owing to sunless days. Early Julian, Keswick Codlin, Gladstone, and Beauty of Bath appear first, and prices are above their intrinsic merit, the present value being about 2*s.* 6*d.* to 4*s.* 6*d.* per half-bushel. Early Italian apples are also offered at 2*s.* to 2*s.* 6*d.* per pad.

Currants continue scarce. We have had a quantity of red from abroad in handle baskets, 7 or 8 lb., for 2*s.* 6*d.*, but some arrived damp and mouldy, and dealers in certain instances lost money on them. Red currants are now 5*s.* and blacks 8*s.* per half-sieve; the latter usually realise higher prices because of the demand for preserving and for jelly.

Plums, half ripe, are arriving in increased quantities, and sell better than usual on account of the general scarcity; 6*s.* to 7*s.* 6*d.* per half-sieve is a high figure for Early Rivers, only half of them being really coloured. They are only useful for cooking purposes.

Greengages are a failure at home, and of imported ones Spanish are best quality at 10*s.* 6*d.* to 13*s.* half-sieve, while French are worth about 8*s.* to 9*s.* 6*d.* for same measure. In boxes, forty gages fetch 1*s.* to 1*s.* 6*d.* when of good mark.

Peaches are slow to ripen, as sunshine has favoured them but little. Selected ones are worth from 6*s.* to 12*s.* per dozen, while *Nectarines* of finest grade realise 7*s.* to 14*s.* per dozen.

Cherries are nearly finished, and the best picked samples have made high prices. The few remaining selected Napoleons sell easily at 4*s.* to 7*s.* a strike, or quarter-bushel. Common qualities are all the ordinary retailer can touch, and these have made 6*s.* to 8*s.* per half-bushel.

Strawberries are virtually over; a few late parcels arrive from Kent, which bring 3*s.* to 3*s.* 6*d.* a peck, but the season is now past.

Raspberries are dearer, and are purchased for preserving at 16*s.* to 18*s.* per cwt.

There is not much expectation in the market of the stone fruit crop in England, and only light consignments are anticipated from the Continent.

Tomatoes of home growth have fallen to the summer price of 2*s.* 6*d.* to 3*s.* per doz. lb.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and SCOTLAND in the Month of July, 1910.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	England. First Quality.	England. Second Quality.	Scotland. First Quality.	Scotland. Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per cwt.†	per cwt.†
Cattle:—	s. d.	s. d.	s. d.	s. d.
Polled Scots	9 3	8 7	44 6	40 7
Herefords	9 4	8 7	—	—
Shorthorns	9 0	8 1	43 8	39 8
Devons	9 3	8 2	—	—
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	8¼	7¼	8½	6¾
Sheep:—				
Downs	8¼	7¼	—	—
Longwools	7½	6½	—	—
Cheviots	8½	8	8½	7¼
Blackfaced	8¼	7½	7¾	7
Cross-breds	8	7¼	8¾	7¾
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs:—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	7 11	7 5	8 2	7 2
Porkers	8 3	7 9	8 4	7 6
LEAN STOCK:—	per head.	per head.	per head.	per head.
Milking Cows:—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	21 13	18 2	22 7	17 19
,, —Calvers... ...	21 5	18 0	21 7	17 7
Other Breeds—In Milk ...	19 0	15 16	19 8	16 7
,, —Calvers ...	15 10	12 12	19 14	16 7
Calves for Rearing	2 8	1 16	2 16	1 19
Store Cattle:—				
Shorthorns—Yearlings ...	10 6	8 18	10 13	8 17
,, —Two-year-olds...	14 10	13 0	15 5	13 6
,, —Three-year-olds	18 4	15 12	18 19	15 2
Polled Scots—Two-year-olds	—	—	16 11	14 11
Herefords— ,,	15 9	13 16	—	—
Devons— ,,	14 1	12 14	—	—
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	29 5	25 7	—	—
Scotch Cross-breds ...	—	—	35 6	29 3
Store Pigs:—				
Under 4 months	32 6	25 10	30 1	24 5

* Estimated carcass weight.

† Live weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND and SCOTLAND in the Month of July, 1910.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Quality.	Birmingham.	Liverpool.	London.	Manchester.	Edinburgh.	Glasgow.
		per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.
BEEF :—							
English	1st	60 6	62 0	62 0	61 0	66 0*	67 6*
	2nd	56 0	57 0	59 0	58 6	59 0*	63 6*
Cow and Bull ...	1st	53 6	51 6	52 0	53 0	50 0	53 0
	2nd	46 6	45 0	47 0	48 6	43 6	42 6
U.S.A. and Canadian :—							
Port Killed ...	1st	—	62 0	62 6	60 6	—	65 6
	2nd	—	56 6	59 0	58 6	—	62 0
Argentine Frozen—							
Hind Quarters...	1st	34 6	31 6	31 6	31 6	35 0	33 0
Fore ,, ...	1st	25 6	24 6	24 6	25 0	25 6	26 0
Argentine Chilled—							
Hind Quarters...	1st	41 0	38 0	41 0	38 0	41 6	41 6
Fore ,, ...	1st	29 0	27 6	28 0	28 0	28 0	29 0
American Chilled—							
Hind Quarters—	1st	—	60 6	62 0	60 6	62 6	—
Fore ,, ...	1st	—	40 0	39 0	40 0	41 0	—
VEAL :—							
British	1st	62 0	73 0	64 6	66 6	—	—
	2nd	55 0	64 6	59 6	62 0	—	—
Foreign	1st	—	—	64 0	—	62 0	—
MUTTON :—							
Scotch	1st	—	73 6	73 0	74 6	68 0	75 0
	2nd	—	69 0	70 0	70 0	58 6	60 0
English	1st	65 6	66 6	64 0	67 0	—	—
	2nd	53 6	60 6	59 6	62 6	—	—
Argentine Frozen ...	1st	34 0	33 0	32 0	33 0	33 6	32 6
Australian ,, ...	1st	32 0	29 0	29 6	29 0	—	32 6
New Zealand ,, ...	1st	34 0	—	36 0	—	—	—
LAMB :—							
British	1st	69 0	70 6	79 6	71 0	72 0	81 6
	2nd	65 6	64 0	74 6	66 0	63 6	70 0
New Zealand ...	1st	52 0	51 6	49 6	52 0	55 0	53 0
Australian	1st	48 0	45 6	43 6	45 6	—	48 6
Argentine	1st	48 6	46 0	43 0	46 0	44 6	47 0
PORK :—							
British	1st	67 0	59 6	66 6	60 6	63 6	65 0
	2nd	60 6	56 0	61 0	56 0	58 6	63 0
Foreign	1st	—	—	65 6	—	—	—

* Scotch.

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1908, 1909 and 1910.

Weeks ended (*in* 1910)	WHEAT.			BARLEY.			OATS.		
	1908.	1909.	1910.	1908.	1909.	1910.	1908.	1909.	1910.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Jan. 1 ...	35 1	32 0	33 3	26 9	26 7	25 1	18 4	17 4	17 4
„ 8 ...	35 2	32 9	33 6	26 9	26 11	24 11	18 3	17 5	17 2
„ 15 ...	35 5	32 8	33 8	27 1	27 1	24 11	18 5	17 5	17 7
„ 22 ...	35 6	33 2	33 9	26 11	27 3	24 11	18 5	17 8	17 6
„ 29 ...	35 0	33 0	33 6	26 11	27 6	25 0	18 4	17 9	17 4
Feb. 5 ...	34 3	33 4	33 7	26 9	27 7	24 10	18 3	17 10	17 7
„ 12 ...	33 1	33 8	33 4	26 9	27 8	24 9	18 0	17 11	17 11
„ 19 ...	32 6	34 1	33 0	26 5	27 11	24 6	17 11	18 0	18 0
„ 26 ...	30 11	34 5	32 7	26 3	28 0	24 2	17 8	18 0	17 10
Mar. 5 ...	30 5	34 10	32 7	26 1	27 11	24 6	17 8	18 2	18 1
„ 12 ...	31 3	35 8	32 6	26 0	28 4	24 1	17 10	18 2	18 0
„ 19 ...	31 7	35 9	32 6	26 2	28 0	23 6	17 11	18 5	18 0
„ 26 ...	31 4	36 0	32 9	25 10	28 0	23 7	17 10	18 6	17 11
Apl. 2 ...	31 3	36 5	33 0	25 5	27 10	23 8	17 9	18 8	18 0
„ 9 ...	31 2	37 4	33 6	25 10	28 0	23 1	17 7	18 10	17 11
„ 16 ...	30 11	38 7	33 7	26 1	27 8	23 5	17 7	19 2	18 3
„ 23 ...	30 10	41 4	33 7	25 5	28 2	23 0	17 9	19 9	18 3
„ 30 ...	31 6	42 5	33 0	25 8	27 10	22 10	18 0	20 0	18 3
May 7 ...	32 4	40 9	32 6	25 5	27 7	22 7	18 4	20 3	18 2
„ 14 ...	33 1	41 6	32 1	24 9	27 3	22 0	18 7	20 6	18 1
„ 21 ...	33 8	42 8	31 10	25 9	27 0	21 8	18 10	20 11	17 8
„ 28 ...	33 5	42 6	31 3	24 6	26 3	21 4	18 8	21 0	17 10
June 4 ...	33 1	43 1	30 2	25 10	25 7	21 8	18 4	21 3	17 10
„ 11 ...	32 7	42 11	29 1	24 5	26 10	20 9	18 4	21 4	17 10
„ 18 ...	32 0	42 7	29 0	24 2	26 10	18 11	18 5	21 6	18 0
„ 25 ...	31 5	42 8	29 4	24 0	27 2	20 1	18 7	21 7	17 9
July 2 ...	30 11	42 9	29 9	23 11	27 2	19 11	18 7	21 9	17 7
„ 9 ...	30 5	43 0	30 4	24 4	26 4	19 5	18 5	21 8	17 4
„ 16 ...	30 7	43 3	31 1	23 1	26 10	21 3	18 5	21 9	17 7
„ 23 ...	31 5	44 0	31 11	26 5	27 4	19 9	18 6	22 5	17 5
„ 30 ...	31 10	43 5	33 5	24 4	24 6	20 10	18 7	22 2	18 1
Aug. 6 ...	31 6	44 9	33 9	23 1	27 4	20 5	18 9	22 11	18 3
„ 13 ...	31 6	44 9		23 10	24 9		18 1	21 8	
„ 20 ...	31 2	41 6		24 5	23 11		17 10	19 8	
„ 27 ...	30 10	38 5		24 5	24 7		17 1	19 4	
Sept. 3 ...	30 10	37 2		25 5	26 3		17 3	19 6	
„ 10 ...	31 5	34 11		25 11	26 1		17 6	18 5	
„ 17 ...	31 7	33 6		26 0	26 5		17 3	17 9	
„ 24 ...	31 5	32 9		26 8	26 8		17 2	17 7	
Oct. 1 ...	31 7	32 2		26 11	26 9		17 2	17 2	
„ 8 ...	31 5	31 8		27 5	26 9		17 0	17 0	
„ 15 ...	31 2	31 4		27 6	27 0		17 0	17 0	
„ 22 ...	30 11	31 8		27 5	27 7		16 11	16 11	
„ 29 ...	30 8	31 10		27 5	27 9		16 11	17 0	
Nov. 5 ...	30 11	32 5		27 6	27 9		17 0	17 0	
„ 12 ...	31 2	32 5		27 4	27 7		17 0	17 1	
„ 19 ...	31 10	32 7		27 3	27 0		17 3	17 4	
„ 26 ...	32 3	33 0		27 2	26 8		17 5	17 3	
Dec. 3 ...	32 7	33 3		27 2	26 1		17 4	17 4	
„ 10 ...	32 8	33 3		27 0	25 7		17 4	17 3	
„ 17 ...	32 9	33 2		26 9	25 3		17 3	17 4	
„ 24 ...	32 2	33 1		26 8	25 2		17 2	17 4	

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lbs.; Barley, 50 lbs.; Oats, 39 lbs. per Imperial Bushel.

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE, BELGIUM, and GERMANY, and at PARIS, BERLIN, and BRESLAU.

—		Wheat.		Barley.		Oats.	
		1909.	1910.	1909.	1910.	1909.	1910.
		s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
France :	June	44 6	41 10	28 5	25 5	24 9	21 4
	July	44 1	42 10	28 2	25 4	24 8	21 1
Paris :	June	46 7	42 6	25 5	24 4	27 2	20 6
	July	45 8	45 6	29 8	23 6	26 11	21 7
Belgium :	May	42 5	35 4	26 10	23 8	23 3	20 1
	June	45 5	—	25 11	—	25 5	—
Germany :	May	52 9	44 0	30 6	24 10	26 1	20 7
	June	56 10	40 5	29 11	24 3	27 3	20 1
Berlin :	May	55 6	46 1	—	—	25 5	20 10
	June	57 5	42 9	—	—	26 6	20 5
Breslau :	May	51 6	41 0	32 6 (brewing) 26 0 (other)	25 4 (brewing) 23 3 (other)	25 3	19 6
Breslau :	June	57 7	39 7	32 6 (brewing) 26 0 (other)	25 4 (brewing) 22 11 (other)	26 3	19 3

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique* ; the Belgian quotations are the official monthly averages published in the *Moniteur Belge* ; the German quotations are taken from the *Deutscher Reichsanzeiger*, the prices for the German Empire representing the average of the prices at a number of markets.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of July, 1909 and 1910.

—	Wheat.		Barley.		Oats.	
	1909.	1910.	1909.	1910.	1909.	1910.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
London...	41 4	32 2	26 9	21 5	20 6	19 2
Norwich	42 8	30 9	26 10	18 4	21 7	16 10
Peterborough	43 7	31 0	26 11	19 2	21 8	17 2
Lincoln...	43 4	31 4	—	19 5	22 4	17 7
Doncaster	43 2	30 3	—	21 5	22 1	17 11
Salisbury	43 7	31 0	25 8	19 10	21 9	17 8

Average Prices of Provisions, Potatoes, and Hay at certain Markets in England and Scotland in the Month of July, 1910.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Bristol.		Liverpool.		London.		Glasgow.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British ...	13 0	12 0	—	—	13 0	11 3	14 0	—
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery	110 0	108 0	106 6	103 6	107 6	104 6	107 6	—
,, Factory	100 0	96 0	96 0	89 0	101 6	98 0	—	—
Danish ..	—	—	116 0	114 0	115 6	113 6	115 6	—
Russian ...	105 0	99 0	102 0	97 6	100 6	96 6	102 0	97 6
Australian ...	107 6	103 0	—	—	103 6	101 0	—	—
New Zealand	114 6	108 0	—	—	109 6	107 6	—	—
Argentine ...	110 0	108 0	102 0	99 0	108 0	106 0	—	—
CHEESE :—								
British—								
Cheddar ...	74 0	64 0	69 0	66 0	69 6	61 6	56 0	51 0
			120 lb.	120 lb.	120 lb.	120 lb.		
Cheshire ...	—	—	62 6	57 6	68 6	60 0	—	—
			per cwt.	per cwt.	per cwt.	per cwt.		
Canadian ...	54 6	53 6	54 6	53 0	55 0	53 0	54 0	52 0
BACON :—								
Irish	82 6	79 6	82 0	80 0	83 0	81 0	83 0	81 6
Canadian ...	80 0	78 0	78 0	76 0	80 6	77 6	80 0	78 6
HAMS :—								
Cumberland ...	—	—	—	—	119 0	106 0	—	—
Irish	—	—	—	—	106 6	99 6	100 0	97 0
American (long cut) ...	85 6	82 6	85 0	79 6	83 6	80 0	85 0	83 0
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British ...	10 7	9 9	—	—	10 7	9 7	—	—
Irish	9 5	8 8	9 4	8 0	9 7	8 10	9 1	8 4
Danish ...	—	—	9 8	9 0	10 1	8 7	9 7	8 5
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Duke of York	80 0	70 0	—	—	91 6	80 0	—	—
Early Puritan .	—	—	—	—	91 6	80 0	—	—
Other First Earlies	106 6	86 6	120 0	100 0	96 6	81 6	83 6	73 6
HAY :—								
Clover ...	95 0	80 0	73 0	60 0	95 0	76 0	86 0	81 0
Meadow ...	80 0	65 0	—	—	87 0	66 0	—	—

DISEASES OF ANIMALS ACTS, 1894 to 1909.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	JULY.		SEVEN MONTHS ENDED JULY.	
	1910.	1909.	1910.	1909.
Swine-Fever:—				
Outbreaks	179	232	910	1,143
Swine Slaughtered as diseased or exposed to infection ...	1,731	1,960	8,239	10,186
Anthrax:—				
Outbreaks ... ..., ...	92	105	906	825
Animals attacked	115	147	1,099	1,103
Foot-and-mouth Disease:—				
Outbreaks	2	—	2	—
Animals attacked	15	—	15	—
Glanders (including Farcy):—				
Outbreaks	38	47	219	346
Animals attacked	147	123	655	1,294
Sheep-Scab:—				
Outbreaks	14	8	329	464

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)

DISEASE.	JULY.		SEVEN MONTHS ENDED JULY.	
	1910.	1909.	1910.	1909.
Swine-Fever:—				
Outbreaks	10	25	67	75
Swine Slaughtered as diseased or exposed to infection ...	285	525	1631	1322
Anthrax:—				
Outbreaks	1	—	5	3
Animals attacked	1	—	8	3
Glanders (including Farcy):—				
Outbreaks	—	—	1	—
Animals attacked	—	—	2	—
Sheep-Scab:—				
Outbreaks	11	20	343	305

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[NOTE.—The receipt of *annual* publications of foreign agricultural and other departments, experiment stations and societies is not noted in the monthly list of additions to the Library. A list of these publications appeared in the *Journal* for October, November and December, 1909.]

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THE DEVELOPMENT OF THE DAIRY SHORTHORN.

A. T. MATTHEWS.

MILK is a necessary article of diet, and it is therefore a matter of vital consequence to the people at large, not only that the supply should be pure and of good quality, but also sufficiently abundant to prevent its price from rising beyond a reasonable level. There are two ways in which the home supplies can be increased. First, the number of cows kept for dairy purposes may be increased, and, second, the milk-yielding capacity of herds now in existence may be enlarged by breeding and selection. Statistics show that the number of cows and heifers in Great Britain, in milk or in calf, has, in fact, steadily increased during the last eight years, whatever may have been the fluctuations of other cattle, and it is probable that this process will continue. At the same time, the enlargement of the milk supply by improving the yield of cows individually is obviously the more economical of the two methods.

In dealing with this subject, it is not desired to enlarge on the claims of the Shorthorn to any superiority as a breed over any other in a general sense, but there is no escaping the fact that an overwhelming majority of the dairy cattle of this country are of the Shorthorn type, though varying

greatly in purity of descent. It is the general purpose animal, scattered over the whole country, and is constantly spoken of as the "National Breed." The chief reasons for the general adoption of the Shorthorn over such a large portion of the British Isles were its combination of beef with milking capacity, and its singular adaptability to all soils and climates.

It is not necessary to trace the history of the breed beyond indicating briefly some of the vicissitudes through which it has passed, which affected its milking capacity, and led finally to the movement inaugurated in recent years with the avowed object of increasing the yield of milk.

The Early Improvers.—There were many celebrated breeders of Shorthorns before the advent of the brothers Colling, who were born in the years 1749 and 1750, but it is generally admitted that the breed, as it then existed in the Teeswater district of Durham and Yorkshire, owed to those two remarkable men the foundation of its future greatness and world-wide reputation. The chief aim of these pioneers was to transform the Shorthorn from a draught animal suitable for farm work to a producer of superior beef and abundance of milk, and their efforts were attended with astonishing success. There is ample evidence that the "Improved Shorthorn," as it came to be called, was in those early days pre-eminent as a milker, and would have so remained had it not been for the influences which subsequently arose, and caused the requirements of the butcher to supersede those of the dairy-farmer. In fact, the contention of modern breeders is that Shorthorns were originally very deep milkers, and that their mission is to restore rather than to create that propensity.

Shorthorns Originally Deep Milkers.—All histories of the breed agree that very heavy yields of milk were the rule rather than the exception a hundred years ago, and many particulars are on record of the yields of individual cows which can be quoted in support of the statement. Of these a few instances may be given, beginning with the cow Duchess, by Daisy Bull, the property of Mr. Bates, and one of the earliest dams given in the pedigree of the famous Duchess tribe. In the summer of 1807, on grass alone,

without other food, she gave 28 quarts per day, yielding 42 oz. of butter. The cow Princess, by Favourite, the property of Robert Colling, was an extraordinary milker, and her descendants were long celebrated as dairy cattle. So much so, in fact, that when, at a later period, Sir Charles Knightley found that his herd had deteriorated in this respect, he procured a bull of Princess descent, whose use at once restored it. Mr. Sinclair, in his "History of Shorthorn Cattle," says:—"Mr. Laken, of Powyke, Worcestershire, who died about 1848, is stated to have been an exceedingly careful observer, and a man recognised as an authority amongst his neighbours. He reported that, after many trials, he could find no cattle so profitable as milkers as the pedigree Shorthorns. He published a return of the yield of milk in his dairy taken over many years. From this it appeared that a cow called Strawberry (which lived to be twenty-seven years old, and is registered in Coates's Herd Book) gave an average of 1,050 gallons a year for fifteen consecutive years. Her daughter, Star, gave an average of 800 gallons for seven years, whilst Stella had a record of 980 gallons per annum for five years. Another prime cow of Mr. Laken's, named Novice, yielded 1,040 gallons a year for five years."

Many more examples might be given, from authenticated history, of pedigree Shorthorn cows giving yields even larger than the above, but these may be sufficient to show that the Shorthorn breed, at the time it left the hands of the pioneers of improvement, was renowned for its splendid milking qualities. The ordinary, unregistered Shorthorn cows of Yorkshire were also at that time of large frame with very capacious udders, and many of them have remained so to this day. There are, indeed, fine herds of these dual-purpose cattle still in existence, which have maintained their dairy character untouched by the subsequent adverse influences.

Loss of Dairy Qualities.—How pedigree Shorthorns came to lose their once famous dairy qualities has now become a matter of ancient history. It was a gradual process, due to two distinct causes, viz., breeding for beef points on the one hand and line breeding on the other. The former was encouraged by the great development of the show system, the

sole object of which seemed to be the production of compact, thick-fleshed cattle, carrying as much roasting meat as possible, with heavy hind-quarters, and the top and bottom lines forming a parallelogram. One cannot blame the agricultural societies or the judges themselves for endeavouring to meet what was an obvious want of the times. The great development of industry in the nineteenth century, with its consequent prosperity, created a demand for luxuries of all kinds, including superior beef. Then came the American demand, and buyers of Shorthorns for the United States were all for beef animals, while disregarding the milking capacity. It is no wonder then that beef points were studied to the exclusion of milk, which was then plentiful enough, with the result that the perfect butcher's type became the ideal both of the exhibitor and grazier.

It is doubtful, however, if the cultivation of the show-yard type was responsible for the decline in the general milking powers of the Shorthorn to as great an extent as the extraordinary craze for line breeding which set in about the same time, and reached its zenith in the 'seventies. The Shorthorn world was cut up into groups, the chief ones being the adherents of Bates and Booth. Certain tribes were "fashionable," and the closer their breeding within particular prescribed lines, the more valuable the animals became, and fabulous sums were paid for specimens of such tribes as the "Duchess," "Oxford," "Cambridge Roses," &c., provided there were no "out-crosses" in their pedigrees. "Straight" breeding was the only passport to fancy values, and personal merit, from the grazier's or dairy farmer's point of view, became of little account.

From such a policy disastrous results were sure to follow, but its bad effects would have been comparatively limited to those lines of blood which ran within the magic circle had it not been for the extraordinary hold which these types had taken on the imagination of the ordinary breeders. With few exceptions, their great aim was to permeate their herds with the blood of the most valuable tribes, and one instance occurs to the writer in which a tenant farmer gave 650 guineas for a bull. The result was that the milking properties of the breed were utterly neglected by both sections of the

leading breeders, the one being absorbed in the pursuit of "correct" pedigree, and the other thinking only of show-yard successes or breeding for beef alone. Milk was ignored or sacrificed to other objects, and this went on through several decades during the last century, till a deep milking pedigree Shorthorn became a rarity, and it was thought quite sufficient if a cow could rear her own calf.

Effect on Common Stock.—We must now glance at the effect of this treatment of the breed on the common stock of the country, a very large proportion of which was of Shorthorn extraction. In doing so, it must be borne in mind that fifty years ago only a few farmers sold new milk, and that the majority of those who bred and reared calves sold them as graziers at three years old, the best of the cows going to town dairies. It was not particularly to their interest to study milk, but rather the production of quick-growing, thick-fleshed animals, such as the show-yard presented them as examples. Though only a few of the ordinary farmers purchased pedigree bulls, those saved for breeding purposes were chosen for beef points, and most of them contained some infusion of pedigree blood. Thus the rank and file followed in the footsteps of the owners of pure-bred herds, and milking properties suffered accordingly. Those dairy farmers who did use a pedigree bull were often disgusted with the result, which was generally a falling-off in their produce; they therefore declined to repeat the experiment, and "pedigree" became a by-word with this class of farmer. On the other hand, there have existed herds in Yorkshire and other northern counties which were never registered, but always bred on the old dairy lines, and these are now in great request and fetch long prices. These, however, are the exception and not the rule amongst the general stock of the country, which, it may safely be said, have, as a whole, sadly deteriorated in milk production.

Rise in the Demand for Milk.—Towards the close of the century the situation changed. The improved means of transit and the development of the cattle-raising industry abroad led to the introduction of frozen beef, which caused a heavy fall in our market prices, even before the trade had assumed serious dimensions. Year by year imports increased

in volume, till it was feared by many that home production would never again successfully compete with them. But, side by side with this movement, another influence was at work which was destined to have a compensating effect on British agriculture. This was the steadily growing demand for new milk, an article in which the farmers of this country enjoyed a practical monopoly. Thousands availed themselves of this refuge from ruin, and were able by its means to keep on their farms through the worst years of depression. Our increasing population calls continually for more milk, and though there is no actual scarcity at present, more cows and better milkers are badly wanted to supply it. Prices continue moderate, though generally remunerative, and it is obvious that they would be more so if, by larger yields, farmers could produce the same quantity with a smaller number of cows.

The Improvement of Shorthorns as Milkers.—It was not till the last few years of the century that anything practical was done by breeders towards the improvement of Shorthorns as milkers, but it then began to be seen by a few thinking men that the interests of dairy farmers had been neglected, and that the reputation of the pedigree Shorthorn as a dual-purpose animal had suffered. Milk selling had become a vital portion of the business of a vast number of farmers, who found almost insuperable difficulties in breeding or finding cows to yield sufficient milk to make them profitable. If they purchased a pedigree bull, the chances were that the progeny were much more suited for grazing than the dairy, and the utmost they could do was to select a bull from a neighbour's herd from a cow supposed to be a good milker, though there was no dependence on the result. What was wanted was a strain of cattle bred on scientific lines for milking purposes, with records of good performances on both sides for two or three generations. From such a source bulls might be procured with such prepotency that the dairy farmer could rely upon them to improve the milk-yield of his whole herd. But such a strain did not exist among pedigree Shorthorns, though there were plenty of fine herds in the northern counties, virtually pure bred but without

pedigree, which had retained their ancient character for deep milking. To secure bulls from these, farmers would go long distances to such markets as Chester and Preston, to which batches would be sent from Yorkshire and adjoining counties.

During several years the subject was ventilated by discussion, but the first object-lesson was given by the British Dairy Farmers' Association, who demonstrated that the pure-bred Shorthorn still possessed deep-milking properties, latent in most cases, but only awaiting skilful breeding and treatment to bring them to the front, and the work of Messrs. Tisdall, Carrington, and Edwards in connection with this matter, at the earlier London Dairy Shows, had a far-reaching effect, and will not soon be forgotten.

A very great step in advance was taken, when, after much persistent advocacy by Mr. Richard Stratton and others, the Shorthorn Society commenced in 1901 to give prizes for milking Shorthorns, although in so doing no definite aim was claimed. The movement served the great purpose of setting certain breeders to think, and in 1905 they formed a new society, called the "Dairy Shorthorn (Coates's Herd Book) Association." Very wisely the founders of this body refrained from starting a separate Herd Book, which would have served no good object, but might have had the effect of splitting the Shorthorn interest into two distinct sections. Their object was not to introduce a cleavage in the Shorthorn ranks, but to restore the reputation of the breed as general purpose cattle, and incidentally to meet the growing national demand for milk.

The measures adopted by the Association were, and are still, chiefly confined to the offering of premiums at the various shows, with certain stipulations. Amongst these were the selection of special judges, and the fixing of a minimum for the yield of milk as given in the show-ring, in order to entitle a cow to take a prize.

The Association inculcates and encourages the keeping of careful records by its members. This is an onerous but necessary task, because, without a regular system of weighing and registering the yield at every milking, a herd can never attain its maximum value. The record is now

becoming quite as important a factor in the sale of an animal as the pedigree itself. The Dairy Shorthorn Association recognises this, and publishes a list of the yields of its members' cows in its annual report.

Milk Records.—The theory held by the leading breeders in this movement is that the milk record must be their chief guide in selection and breeding, and that no bull can be relied upon to produce deep-milking stock unless the progenitors on both sides for three, or at the very least two, generations, can be shown to have possessed deep-milking propensity.

It is obvious, therefore, that the object of the Dairy Shorthorn movement (which is that of breeding reliable sires for the dairy farmer) can only be fully attained by steady persistence for a term of years, only a very few of which have yet elapsed since the movement was set on foot.

The difficulties are augmented by the fact that the pioneers have, more or less, to work in the dark as to the hereditary tendencies which may exist unsuspected in the sires they may select, and many severe disappointments have already occurred from this cause. Bulls have been purchased at high prices, of great personal merit, and apparently suitable pedigree, but owing to what is called atavism, or the tracing back to some ancestor more or less remote, the resulting progeny have turned out very moderate milkers, and thus the work of years has to be done over again.

These misfits, as they are sometimes called, are the more likely to occur because the dairy breeders, in order to attain their object, have to undo the work of those in the past who have made strenuous efforts in an opposite direction. In other words, breeding for beef has vastly increased the difficulties of those who are now breeding for milk.

There are now a number of breeders who are devoting attention to the development of the Dairy Shorthorn, and it is thought by some authorities that the breed will tend to be divided into two distinct types, as it is recognised that deep milking and the perfect butcher's form cannot be united in the same animal. The enterprise is intended to meet a great want which is now keenly felt by British dairy farmers. They require bulls on which they can rely with reasonable

certainty for increasing their milk-flow, and the difficulty of finding them has been steadily increasing for many years. It may be some time before such animals will be procurable at prices within the means of the ordinary farmer, but already there are some local societies devoting funds for the purchase of dairy bulls for the use of their members. This course of action should be encouraged in every possible way, for no organisation could better justify its existence than by assisting the farmers in the district in adopting methods of production leading to greater profits for themselves, and an increased supply of an article so indispensable to the public as new milk.

BRIE, PONT L'ÉVÊQUE AND OTHER SOFT CHEESE.*

JOHN BENSON.

Brie.

THE Brie cheese is a very popular variety in France. It is softer and more creamy in texture than the Camembert, resembling a good cream cheese, but necessarily of different flavour.

It is larger than the Camembert, but the ripening process is similar, and it owes its distinctive flavour and qualities to the action of moulds which grow upon its surface. In the matter of curing rooms and method of manufacture, the requirements are very similar to those of the Camembert, though the temperatures at which the various rooms are kept vary somewhat.

The aim of the maker is to obtain a cheese which will ripen rapidly and regularly. The first point is chiefly a matter of manipulation, while the second depends upon the growth and development of certain types of moulds and ferments. In order that a cheese may ripen quickly, it must contain an excess of moisture and be non-coherent; to ensure this condition a slow coagulation of the milk is necessary, and this means the employment of a very small quantity of rennet and the use of sweet milk.

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* An article on Camembert Cheese, containing general directions for making soft cheeses, appeared in the previous issue of this *Journal*, p. 371.

The milk is usually brought direct from the cowsheds while retaining its animal heat, and the rennet is added at a temperature of from 82° to 86° F. About 14 lb. of milk are required to produce a cheese of standard size, and coagulation should be complete in about four hours.

When the curd is ready to be ladled out it should be shorter than is the case with Camembert, and should have shrunk a little in the cheese-tub, to the extent at least that whey appears upon the surface. The hoops or cheese-moulds are usually 10½ ins. in diameter by about 4 ins. in height, and the ladle for scooping out the curd is similar in shape to the old-fashioned cream-skimming dishes in use in many dairies. The moulds are laid singly upon straw mats resting upon boards, and the curd is placed in them in horizontal thin slices.

The best cheeses are made of two curds, as described in the manufacture of Camembert. When the two curds have sunk just below the rim of the lower mould, the upper ring is removed, the cheese is covered with a clean straw mat and a board, and reversed.

The cheese is again turned at the end of three or four hours, clean mats being used at each turning. It is essential that the mats be crossed at turning so that the marks of the straws show in cross section. This is important, as when the straws are crossed air is admitted more readily to the under surface and ripening is more regular. When the cheese is firm enough to admit of the hoop being removed, it is salted on the surface with fine dry salt, which should be spread very evenly upon the whole surface. After the first salting the cheese is left for from eight to ten hours, and then turned on to a round osier mat termed a *clayette*. It is then again salted upon the now upper surface and the sides, and removed to a drying room which is kept at a temperature of from 63° to 65° F., to shelves so placed that gentle currents of air can be admitted over the surface of the cheeses. When placed in this drying room the cheese is solid and rather firm, but friable and very acid.

In the course of a day or two, if the cheese has been properly made, there should appear upon the surface a white fungus mycelium which grows rapidly in a warm and

fairly moist atmosphere. With the best cheeses a reddish mould succeeds the white mould, though with many of the coarser cheeses a blue mould succeeds the white. The latter, though common, are not the true type, a cheese growing a red mould being always superior in quality.

When this red mould is well established on the cheeses, they are removed to the cellar or cave where ripening is completed. If the cheeses are to be kept for any length of time they should be placed in very cool dry cellars at an early stage in the ripening process.

It will be gathered that the method of manufacture of Brie is somewhat different from that of Camembert. The object of the maker is to conserve more moisture in the curd and to ripen in a shorter period. Hence coagulation of the milk is slower, and the temperature of the making room is lower. These two factors tend to slow and incomplete drainage during the first stages. After being properly formed and salted, the cheeses are placed in the second ripening room at a higher temperature, and this room is kept more moist than would be the case with Camembert. This tends to rapid growth of the moulds and quick ripening, and a soft texture in the cheese. In the cellar the temperature will vary, depending in a great measure on the period at which the maker wishes to dispose of the cheese.

The cheeses when ripe are usually cut up into diamond-shaped pieces, placed in boxes of the same shape, and retailed in this form.

Pont l'Évêque.

The cheese known as the Pont l'Évêque has acquired a considerable reputation in England, and though usually designated a soft cheese, it is of a type entirely different from the Camembert and Brie.

The ripening of this cheese is not dependent upon the growth of moulds, but is probably largely due to the enzymes of rennet introduced in a comparatively large quantity during the first stage of manufacture.

The cheeses are either square or oblong with "rounded corners." They are $1\frac{1}{4}$ ins. in thickness, and weigh about

1 lb. each. When ripe they present a brownish-red exterior, are pliant and yielding to the touch, and the peculiar flavour somewhat resembles that of a very fine soft Edam cheese, though more sweet to the taste.

In the manufacture of this cheese the lactic acid ferments play a very unimportant part. Indeed, it is the practice to rennet the milk and so handle the curd as to exclude as far as possible the action of lactic acid producing ferments. A milk at all acid or to which a lactic acid starter has been added is altogether unsuitable for the manufacture of Pont l'Évêque. If at all acid during the first stages of manufacture the cheeses dry and get hard quickly, and fail to take the salt. In the later stages they get hard and dry, and are of no value.

The Pont l'Évêque cheese is somewhat difficult to manufacture. The various mechanical processes are simple enough, but the whole secret of success depends on the ability of the maker to determine when the curd is ready to hoop. Perhaps not more than 1 per cent. of English makers are really able to determine the exact stage at which to hoop the curd. If at this stage the curd is too hard and dry, the cheeses will drain inordinately and become hard; whereas if the curd is too moist or has been chilled, the cheeses will contain an excess of moisture, and in the course of a few days will spread out into an unshapely mass in the curing room and become quite unpalatable.

The cheeses are rendered more difficult of successful manufacture by the very fact that acidity of the curd during the earlier stages is not admissible.

The method of manufacturing Pont l'Évêque is as follows: —About 50 lb. (for six cheeses) of perfectly fresh new milk should be strained into a wooden tub of 6 gallons capacity. If the milk has fallen to below 90° F., then it should be raised to this temperature or a little higher before rennet is added.

The usual setting temperature is from 90° to 94° F., and rennet of a good standard brand is added at the rate of one dram (mixed with six drams of water) to each 20 lb. or 2 gallons of milk. Many makers add a quart of boiling water to each 5 gallons of milk before putting in the rennet. This is good practice, as it tends to the production of a soft

cheese. It will be observed that the proportion of rennet used is comparatively large, and this is necessary if the cheeses are to ripen properly, for, as already stated, the ripening is almost entirely due to the enzymes contained in the rennet.

After the addition of rennet the milk is stirred carefully at intervals for four or five minutes, and then covered up and kept as warm as possible. In from thirty to forty minutes coagulation will be firm and complete. At this stage the curd is cut vertically with a long knife into one-inch square sections, which are then cut diagonally across. This cutting is done to ensure rapid drainage of the whey from the curd, and should be carefully and thoroughly performed. A sharp-edged skimming dish or flat scoop is now inserted about three-fourths of an inch deep, thus cutting the curd horizontally, and the curd is ladled out into warm straining cloths thrown over wooden forms resting on a draining-table. This operation should be done quickly and carefully, as it is necessary to keep up the temperature. When all the curd has been ladled out, the corners of the cloth should be brought together but not tied. The curd will drain more quickly if spread out in a thin layer, and the temperature can be kept up by the use of warm dry cloths spread over the surface. The cloths should be opened out and the curd moved at intervals, drainage being assisted in every way without injuring the quality of the curd.

If the curd has been properly handled, drainage should be complete in about thirty minutes, and the curd should then weigh about one-third of the original volume of milk. At this stage the curd is partly broken up with the fingers and carefully placed in the little hoops or forms which rest in pairs upon straw mats spread over boards. The curd is taken in the fingers and pressed closely and firmly against the sides and bottom of the hoops so as to secure a smooth surface, and great care is necessary to finish the cheeses so that they present a close unbroken exterior. So soon as the moulds are filled they are turned in pairs upon other dry straw mats and boards, and this turning is repeated six or eight times during the first hour. The object of the cheese-maker should be to secure a close tight surface, as unless

the surface is close the cheeses will lose moisture by excessive drainage and be spoiled.

The temperature of the making room should be kept at 65° or 68° F., and the cheeses should be ready to salt in from twelve to sixteen hours after the milk was renneted. The proper stage at which to salt is when the cheeses smell yeasty and are a little greasy upon the outside. Rapid digestive changes occur in these cheeses, and a knowledge of the exact stage at which to salt is important. In salting, the cheeses are lightly covered all over with salt, a little extra being added on the upper surface. Later they are turned and again salted in a similar manner.

The cheeses are kept in the making room for about three days, and are then taken to the curing cellar, which is kept at 58° to 60° F. They are laid on sparred shelves covered with wheat straw, and are occasionally washed with weak brine to prevent the formation of mould.

When the ripening process has proceeded for sixteen or eighteen days, the cheeses are packed together in layers of three to conserve moisture, and occasionally their position is reversed in order to secure uniform ripening. The period of ripening usually extends to five or six weeks, and when the cheeses are ripe they should be soft, but not creamy. A good cheese will show a slight bulging of the sides, and when cut should be uniformly ripe throughout. In this respect it differs from the Camembert and Brie, which ripen gradually from the outside towards the centre.

When ripe the cheeses are packed singly in suitable chip boxes, and realise from 10*d.* to 1*s.* each retail. When properly made they are excellent, and are not so perishable as many other soft cheeses.

Cream Cheeses.

Cream cheeses are extensively manufactured in England during the summer months, but almost every dairy has its own particular method, and no really serious attempt has been made to put upon the market cheeses of uniform quality and flavour.

In flavour the produce of different dairies varies widely, no two dairies being alike, and the flavour of the greater portion of the cheeses made is objectionable. Many makers

appear to think that any sort of cream is good enough with which to make cream cheeses, but this is a mistake. If the cheeses are properly made with the best cream, no more profitable branch of dairying exists than the manufacture of cream cheeses.

Cream intended for cheese-making should be perfectly fresh and sweet to commence with, and any ripening necessary should be undertaken before the cream is placed to drain. The old method of draining the cream by hanging up in a bag or cloth for two or more days is a mistake, as by the time the cream has drained sufficiently it has assumed a bad flavour, which is reproduced in the cheese. In judging the cream-cheese classes at shows it is found that the flavour is at fault in 90 per cent. of the exhibits, and this is almost always due to the protracted period of drainage.

In general, two varieties of cream cheeses are manufactured—the one known as double-cream, from cream containing about 50 per cent. of fat, and the other from thin cream which is thickened with rennet before drainage takes place.

If it is required to make the sweet variety of cream cheese, the cream is drained after standing twelve hours, but if a certain amount of ripening is desired, then a small quantity of starter (usually about half a pint to each gallon) is strained into the cream immediately the temperature has been reduced to 60° F.

This starter may be either a pure culture of lactic acid bacteria, such as is used by most cheese-makers, or it may be a little clean soured milk.

Double-Cream Cheese.—A really good method of making double-cream cheese may be described as follows:—

The cream is taken off thick, and if pasteurised will be so much the better. It is then cooled in cold running water till the temperature is down below 60° F., and is allowed to stand at this temperature for twelve hours.*

The cream is drained in fine linen or longcloth spread over a wooden form, and this form is provided with a loose board which can be weighted when necessary to press out the superfluous moisture.

* Thick cream cooled over a refrigerator does not make good cheeses, the product tending to be coarse and open in texture. The proper method is to cool the cream in pails in cold running water. An interval of twelve hours between separation and drainage is necessary as this develops the flavour and assists in after-drainage.

The cream should be put to drain on a level slate or marble slab or table, and if it has been properly treated only skim milk should exude.

A form large enough to make up one or two gallons of cream at a time will be 18 ins. long, 14 ins. wide, and 4 ins. deep. The pressing board should be $1\frac{1}{2}$ ins. thick, and made of sycamore or canary wood. The fine cloth is thrown over the form and pressed down to the level of the table, and the cream then poured in to the depth of 1 or $1\frac{1}{2}$ ins., covering the whole inner area of the form. The edges of the cloth are now turned over and neatly adjusted so as to cover the whole surface of the cream, the board is placed on, and left for half an hour with a 7-lb. weight on it. Drainage must be gentle at first, or the pores of the cloth get filled with cream. The cloth should be opened out once or twice during the first hour and the sides scraped down, when the cream should be re-weighted with a 14-lb. weight. If the cream is thick and has been properly cooled and prepared before drainage, it should be ready to mould in three or four hours from the time it was put to drain. It will have drained sufficiently when the curd weighs at the rate of 16 oz. to each pint of cream used. A small tinned-copper mould holding $\frac{1}{4}$ or $\frac{1}{2}$ lb. is used, lined on the inside with a strip of parchment, the mould being then placed in the centre of the muslin or paper wrapper and the cheese filled in with a wooden knife.

The cheeses are sold fresh or ripened, but it must always be remembered that cheeses made from fresh cream are perishable, and will not retain a nice sweet flavour for more than two or three days. Those who have a quick sale for their produce may venture to manufacture their cheeses from sweet cream, but if the cheeses are to be kept for any length of time, then the cream should be slightly soured before drainage. Lactic acid is a preservative, and tends to prolong the flavour and keeping qualities of most varieties of cheese.

It is, however, essential that the starter be of right flavour, or the quality of the cheese will suffer. On no account should the cream be allowed to sour naturally, as by the time the cream has become sour the flavour will have suffered otherwise. Natural souring can be hastened by keeping the cream at a higher temperature, but such a procedure results in a

greasy cheese, which rapidly becomes rancid. If it is necessary to salt the cheeses, the salt should be added to the cream, about 1 oz. to each gallon of cream usually being sufficient.

These cheeses realise 4*s*. 6*d*. per dozen wholesale, or 6*d*. each retail.

Single-Cream Cheese.—A very good cream cheese of poorer quality, but having more of a cheesy flavour, can be manufactured from cream containing from 25 to 30 per cent. of fat; many persons prefer this type of cream cheese. In this case also the cream must be cooled to 65° F., and three or four drops of rennet per gallon together with a little starter should be added immediately the cream is cooled, when the whole is left for eight or twelve hours before draining. If necessary, salt may be added to the cream at the same time as the rennet. With a cream that has been coagulated, it is necessary to use a ladle with which to lift out the curd into the cloth. The after methods of preparation and moulding are the same as those already described for double-cream cheese.

The single-cream cheeses can be sold at a lower price, as they contain a fair proportion of casein; the wholesale price is usually 3*s*. 9*d*. per dozen, or 5*d*. each retail.

Cheeses of whatever quality will always be of uniform condition and flavour if made as described. The essentials necessary for the production of prime quality cream cheeses are:—(1) A sweet cream carefully cooled and prepared, and ripened at a low temperature; (*b*) the addition of salt to the cream and not to the finished curd; (*c*) the use of fine *dry* cloths in which to drain off the superfluous moisture; (*d*) to have the cream spread out in a layer of not more than 1 or 1½ ins. deep in the draining form; (*e*) slight pressure during the first stages, increasing gradually to not more than 14 lb.

Neatly printed wrappers should also be used, and if the cheeses are sold wholesale they should be packed in wood pulp boxes holding half a dozen each. It must always be remembered that cream cheeses are particularly liable to become tainted, and hence care should be taken to have all cloths clean and draining forms and boxes made of materials that will not taint the cheeses.

THE COMPOSITION OF SEAWEED AND ITS USE AS MANURE.

EDWARD J. RUSSELL, D.SC.

Rothamsted Experimental Station.

ALL around the coasts of the British Isles and of other countries in northern Europe seaweed has a high reputation as manure. There is no record nor even any tradition to show when it was first used, or how its value was discovered, but it seems to be essentially a northern manure, and is not included in the lists given by the Roman writers. It began to be mentioned as soon as descriptions were written of the husbandry of the coast districts; thus Camden in 1586 says that in Cornwall the valleys are "of an indifferent glebe, which with the Sea-weede or reit commonly called *Orewood* and a certaine kind of fruitfull sea sand they make so ranke and battle that it is incredible." Owen at about the same time tells us that in South Wales "this kind of ore (*i.e.*, seaweed) they often gather and lay in great heaps, where it heteth and rotteth, and will have a strong and loathsome smell; when being so rotten they cast it on the land, as they do their muck, and thereof springeth good corn, especially barley"; and again, "they fetch it in sacks on horse backes, and carie the same, three, four, or five miles, and cast it on the lande which doth very much better the ground for corn and grass."

In the Isle of Thanet, where several thousand cartloads of seaweed may be thrown up by one tide and carried away by the next, Boys writes in 1798 that farmers living at a distance from the sea would hire small pieces of land near the shore on which to lay the fresh weed as they got it, keeping it there till it could conveniently be carted away. The old passageways cut trench-like through the 50 or 60 feet of chalk cliff down to the shore are still used for carting seaweed, and still retain their old Scandinavian name "gates." So important was seaweed deemed in the Channel Islands that its collection and distribution were regulated by law, so that the inland parishes might have their proper share. In 1694 Falle writes: "The Winter *Vraic* being spread thin on the green Turf, and afterwards buried in the furrows by the Plough, 'tis incredible how with its fat unctuous Substance it

ameliorates the ground, imbibing it-self into it, softening the Clod, and keeping the root of the Corn moist during the most parching heats of Summer. In stormy weather, the Sea doth often tear up from the Rocks vast quantities of this Weed, and casts it on the Shore, where it is carefully laid up by the glad Husband-man." Indeed, collective experience in Jersey has crystallised in an old proverb, *"Point de vraic, point de hangard."*

Enormous improvements were recorded in parts of Scotland as a result of using seaweed. In the Reports to the Board of Agriculture published at the end of the eighteenth century many references occur. About 50 bolls to the acre were applied in Forfar, and lasted for three years, giving excellent barley crops. It was much esteemed for barley and turnips in Kincardine, whilst in Dumbarton it was used for grass, oats, and potatoes, the cut weed being considered better than the drift weed. Coming to later times, Murray in 1868 writes: "Where this manure is abundant the rent of arable land is often enhanced from thirty shillings to two pounds per acre, if accompanied by the privilege of gathering the seaweed." Going still further north, seaweed has figured so much in the agriculture of the Shetlands that the old name for a dung fork (taricrook) means literally seaweed fork, *thari* being the old Norse for seaweed. In almost every district where seaweed is obtainable, evidence might be adduced to show the high esteem in which it was formerly held.

It has probably even now lost but little of its old reputation, in spite of the large choice of fertilisers at the command of the modern farmer. It is still diligently collected in the west country just as in Camden's day; the amount available is, of course, very variable, and most comes into the bays facing south and south-west—the direction of the storms. In the market gardening regions of south Cornwall it is not, as a rule, used in the fresh condition, but is mixed with sand as of old and allowed to rot. It is then applied along with guano and superphosphate for early potatoes and cauliflowers. Elsewhere it is put on to the root crops. Mr. Dutton informs me that the material usually collected is *Fucus serratus, F. vesiculosus,* and, after stormy weather, *Laminaria*

digitata. Near some estuaries *Ulva lactuca* is gathered. On the north Devon coast it is used for potatoes and roots; so much is it esteemed as a spring dressing that a certain amount is barged to points inland for the use of farmers too far from the sea for cartage to be profitable. In Jersey not only is the "drift weed" cast up by the tides collected, but weed is cut from the rocks. The dates for cutting the *vraic* are fixed early in the year by the Court, and duly announced; the winter harvest is in March, and the summer harvest in July. As much as 45 tons of the fresh seaweed is applied per acre soon after the crop following early potatoes is out of the way, commonly about the middle of September. Later in the season recourse may be had to seaweed that has been collected, dried, and stacked, this being a regular summer occupation for some of the poorer people of the island. Little if any deterioration seems to set in, if the weed is quickly dried and not exposed to rain, while the saving in cartage is considerable. Digging-in takes place in December and January, and planting with early potatoes follows as soon as practicable. From two to four cwt. per acre of a complete artificial manure are usually given as well.

The light soils of the Isles of Scilly are very dependent on a supply of organic matter to retain moisture; as much as 50 tons of seaweed per acre is, therefore, applied for early potatoes, nearly as much for mangolds and other roots, but smaller dressings are put on for corn. A certain amount is also allowed to rot in piles, and is then used for bulb cultivation and general garden purposes. *Fucus serratus* is most popular, and enjoys the highest reputation, whilst the thick fleshy strands of *Laminaria* are least thought of; indeed, it is considered that they injure the soil if used too freely. The weed is generally gathered between September and March, and is by far the most important fertiliser in the Islands.

In the Isle of Thanet it is used in several ways. The fresh weed is spread at the rate of ten to fifteen tons per acre over lucerne or sainfoin in the early autumn, and then raked off in spring just before the crop starts. It is also put on the land at the rate of ten to fifteen tons per acre before ploughing, and is found to be very beneficial to such market-garden crops as cabbage, celery, asparagus, &c., as well as

the ordinary farm crops. Some is also thrown into the dung mixen. However, it cannot be said to be a very important manure at the present time, and is collected only when other work can be left, the reason probably being that cartage is heavy. A load weighs about a ton, and often requires two horses to get it from the shore; the enormous quantities thrown up by high tides when the wind is from the north or north-east—making a fringe along the high-water mark which may be three or four feet in thickness—sometimes prove more than the market gardeners and farmers on the coast can profitably deal with.

A considerable amount of seaweed is collected in Scotland, where the right of gathering still sometimes forms part of the covenant with the landlord, and has even been the subject of litigation. It appears to be held in special favour on the south-west coast, where there is a good deal of light soil, and cartage presents no particular difficulties; indeed, it is perhaps the chief manure used for early potatoes on the Ayrshire coast, being applied at the rate of 25 to 30 tons per acre in autumn, and then ploughed in. What is gathered in summer is put on top of the "middens" till wanted. Further up the west coast, and also on some of the islands, seaweed is used by the crofters, but it does not appear to be held in so much favour on the east coast, excepting where it can very readily be obtained.

Seaweed is largely used on the Irish coast and on the French coast; at Mont St. Michel there is a considerable trade in seaweed as manure. It is also of great importance in some of the New England coast districts.

The Composition of Seaweed.—The composition of seaweed is largely dependent on that of the sea-water by which it is surrounded, and from which it draws its sustenance, but no systematic investigation from this point of view has yet been made. Nor are there any great number of analyses on record; except those by Anderson, Hendrick, and Toms few data that bear on the subject have yet been published in this country.

When the weed is first thrown up it holds mechanically a considerable amount of water, part of which will drain away and part evaporate. Wet weed may contain as much as 80

per cent. of water, and even 85 per cent. is recorded; well-drained weed contains about 60 per cent., while weed dried by exposure to air in a shed contains 10 per cent. or even less. Weed carted by the farmer would probably contain about 75 per cent. of water on an average.

TABLE I.—*Percentage Composition of Dry Matter of Various Seaweeds.*

Name of weed.	Fucus ceranoides.	Fucus caniculatus.	Fucus serratus.	Fucus.	Laminaria.		Green weeds. Cladophora and Ulva.	Green weeds. Ulva.
Locality	Croyde, N. Devon	Croyde, N. Devon	Thanet, Kent	Jersey	Thanet, Kent	Jersey	Croyde, N. Devon	Thanet, Kent
Date of collection	July, 1908	July, 1908	Feb., 1909	March, 1907	Feb., 1909	March, 1907	July, 1908	Feb., 1909
Organic matter ...	69·80	76·00	75·16	73·86	61·66	63·59	—	—
Nitrogen	1·25	1·53	2·33	2·25	2·14	1·48	1·68	2·70
Total ash	30·20	24·00	24·84	26·14	38·34	36·41	—	—
Sand	5·15	2·67	3·73	1·24	13·15	1·14	—	—
Pure ash	25·05	21·33	21·11	24·90	25·19	35·27	—	—
Phosphoric acid...	0·03	0·03	0·05	0·66	0·06	0·65	0·03	—
Potash...	3·80	2·52	3·70	5·88	4·74	5·76	2·16	—

Composition of Other Substances collected with Seaweed.

	Zostera marina.	Mixed growth—Salicornia herbacea and Glyceria maritima.	Sea mat.	Small shells and general debris.[1]
Locality	Jersey	Thanet, Kent	Thanet, Kent	Thanet, Kent
Organic matter	76·32	61·50	25·80	21·86
Nitrogen	0·68	2·15	2·37	0·97
Ash	23·68	38·50	74·20	78·14
Sand	3·62	16·68	25·80	44·85
Pure ash	20·06	21·82	48·40	33·29
Phosphoric acid... ...	0·70	0·04	0·04	0·02
Potash	0·69	1·28	1·30	0·48

[1] Contained also 21·8 per cent. of calcium carbonate.

In Table I. are given the results of analyses by the writer of a number of seaweeds and of materials commonly gathered at the same time. The samples of *Fucus* from Jersey and from Croyde and the *Cladophora* were cut from the rock; the Thanet sample of *Fucus*, the *Laminaria*, and the *Ulva* were thrown up by the tide. The other figures refer to materials gathered along with the weeds, but quite different from them. *Zostera marina*, or eel grass, its German name being "*seegras*," has green grass-like leaves, and grows in shallow

bays in many districts. It is not a true grass, but is more nearly allied to pond weed (*potamogeton*). *Salicornia* is a chenopod; *Glyceria* is a true grass; both are salt marsh or seaside plants. Sea mat is the tough brown flat structure commonly found with seaweed; in the sea it was a colony of zoophytes, but when cast up on the shore and dried the organisms perish. The organic matter present contains about 9 per cent. of nitrogen, a high figure characteristic of animal residues, but much in excess of anything found in plants. The small shells and debris contained no less than 21·8 per cent. of calcium carbonate.

An inspection of Table I. shows that the nitrogen in the dry matter ranges from 1·25 to 2·7 per cent., being lowest in the Croyde samples taken in summer, and highest in the Thanet samples collected in winter. The total ash is usually 25 to 35 per cent., 1 to 5 parts of which are silica arising partly from silicates and partly from sand entangled with the weed. Very little phosphoric acid is present, sometimes less than 0·1 per cent., and never much more than 0·5 per cent.; the potash, on the other hand, varies between 2 and 6 per cent., *Laminaria* containing more potash than *Fucus*. Soda is present in about the same amount as potash, and there are smaller quantities of lime and magnesia.

The composition of seaweed shows some variation with the time of cutting. Mr. Toms' analyses of Jersey seaweeds, made at different times of the year, indicate that weed cut in October is poorer than that cut in March or May. His results are:—

		Fresh weed.		Percentage composition of the dry matter.					
		Water.	Dry matter.	Organic matter.	Nitrogen.	Ash.	Potash.	Lime.	Phosphoric acid.
Fucus (cut).	March	77·4	22·6	81·4	1·91	18·6	2·62	1·3	0·36
	May	73·4	26·6	79·5	1·98	20·5	2·26	2·1	0·20
	October	76·6	23·4	79·3	1·16	20·7	2·50	1·3	0·85
Laminaria (drift).	March	87·0	13·0	65·0	3·06	35·0	3·45	1·96	1·29
	May	78·0	22·0	74·0	1·94	25·6	3·93	1·70	1·70
	October	82·0	18·0	81·7	0·96	19·3	2·34	1·65	1·65

(*Notes on Farm Chemistry in Jersey*, 1905.)

These analyses further show that *Laminaria* drifting in from

deep water is usually richer than *Fucus* cut from the rocks, especially in potash. The kelp-burners also recognised its superiority as a source of iodine. Mr. Hendrick's analyses of Scotch seaweeds also bring out the same facts, but in this case the samples are not all taken from the same place.

		Fresh weed.		Percentage composition of dry matter.					
		Water.	Dry matter.	Organic matter.	Nitrogen.	Ash.	Potash.	Lime.	Phosphoric acid.
Fucus nodosus.	January	70·78	29·22	78·98	2·60	21·02	4·73	1·30	0·32
	October	74·99	25·01	76·55	2·04	23·45	3·38	1·76	0·36
Laminaria ...	March	78·2	21·8	65·89	2·57	34·11	6·84	2·62	0·80

(*Transactions of the Highland and Agricultural Society*, 1898, page 118.)

Reference to Table I. will show that the other plants—*Zostera, salicornia,* &c.—thrown up on the shore are all poorer in potash than the true seaweeds, while *Zostera* is also poorer in nitrogen. This is very generally true, and is shown in Table II., where analyses of a number of farm crops are given for comparison with the analysis of seaweed.

TABLE II.—*Composition of the Dry Matter of Seaweed and of certain Farm Crops.*

	Fucus and Laminaria. Mean.	Buckwheat at flowering.	Rye in ear.	Mustard at flowering.	Meadow hay.	Clover hay.	Mangolds (roots).	Wheat straw.
Nitrogen	1·83	1·18	0·70	2·30	1·74	2·60	1·67	0·60
Pure ash	25·47	12·00	—	14·70	7·20	6·85	7·21	5·35
Potash	4·40	4·44	2·10	4·20	1·76	2·22	3·77	0·80
Phosphoric acid.	0·24	1·22	0·59	1·00	0·43	0·66	0·62	0·26

Seaweed is therefore characterised by containing more ash, and less phosphoric acid, but about twice as much potash as ordinary farm crops, excepting such specially rich crops as mangolds, buckwheat, and mustard.

Seaweed as Manure.—The material gathered by the farmer is rather mixed, though one or two weeds usually preponderate, especially if, as sometimes happens, weed is cut from

the rocks. Analysis of the Thanet sample which was thrown up by the tide showed the following constituents :—

Fucus serratus	59·7	per cent.
Glyceria maritima and Salicornia herbacea ...	4·3	,,
Laminaria	2·5	,,
Ulva	1·4	,,
Fucus vesiculosus	0·6	,,
Sea mat	1·2	,,
Miscellaneous *débris*	30·3	,,

The composition of various mixed samples as gathered is given in Table III.

TABLE III.—*Percentage Composition of Fresh Seaweed as Gathered.*

	Thanet.	Scotland (1).	Jersey (2).	United States (average of many analyses).	Canada (two single analyses).	
Water	75·00	77·41	77·5	81·5	63·49	79·23
Organic matter ...	14·45	16·30	18·1	—	27·93	15·23
Nitrogen	0·48	0·54	0·27	0·73	0·47	0·17
Potash	1·00	1·24	0·80	1·50	2·02	0·76
Phosphoric acid ...	0·02	0·09	0·12	0·18	0·11	0·04

(1.) Mr. Hendrick's results. (2.) Mean of Mr. Toms' results.

We may summarise all these British results as follows :—

	Wet weed as gathered. Per Cent.	Average. Per Cent.
Water	70 to 80	75
Organic matter	13 to 20	18
Nitrogen	0·3 to 0·8	0·5
Potash	0·8 to 1·5	1·2
Phosphoric acid	0·02 to 0·17	0·09

A considerable amount of water is lost on drying in the air, and if the weed has not been washed by rain in the meantime, its value is increased four, five, or even six fold.

It is difficult to form an estimate of the money value of seaweed to the farmer. The fertilising materials present in 1 ton of seaweed possessing the average composition would cost 8*s*. to 10*s*. if purchased from a dealer. This value is arrived at by allowing 12*s*. for each per cent. of nitrogen, 4*s*. for each per cent. of potash, and 3*s*. for each per cent. of phosphoric acid. No account is taken of the sodium, calcium and magnesium salts, which on most soils, but especially light soils, would be distinctly beneficial; nor is any allow-

ance made for a possible stimulating effect of the iodides present.

In farm practice seaweed more or less takes the place of dung, but there are several important differences. Seaweed contains no fibre, and, consequently, does not produce the black structureless material characteristic of the dung heap; in decomposing it forms soluble substances which easily wash away. For the same reason it decomposes more completely than dung. It is even said to facilitate the decomposition of dung on light soils and in dry districts, but there is no very definite proof. A ton of dung and seaweed would break down in the soil more quickly than a ton of dung alone, and would therefore have less of a drying effect if put on late. The freedom of seaweed from weed seeds and from spores of disease organisms is of considerable advantage on light soils where weeds are common, or on soils liable to such diseases as finger-and-toe, the spores of which can hardly be kept out of dung. It also differs from dung in its bacterial flora, but on this question so little is known that any discussion would be premature.

Experiments to test the manurial value of seaweed have been made at Trondhjem, at the Rhode Island Experiment Station, and by a few workers in Great Britain. In Mr. Hendrick's trials seaweed proved fully as effective as dung for early potatoes so far as quantity of produce was concerned, but it somewhat retarded ripening. On the other hand, seaweed and superphosphate proved better than dung and superphosphate. It is, however, on such gross feeding crops as mangolds and the cabbage tribe that seaweed would be expected to show its fullest effects, and systematic experiments could not fail to bring out some interesting results.

Reference has already been made to the fact that seaweed decomposes more completely than dung, and is converted into soluble or gaseous substances. It should therefore not be allowed to rot in heaps by itself, but should be put straight on to the land, or, if this is not practicable, mixed with any dung which will absorb some of the decomposition products. The value of a heap of seaweed is much lessened by exposure to rain, but exceptions to this rule may arise in the case of special garden crops.

Analysis shows that the seaweeds have not all equal

value as manure. The long, broad, leaf-like *Laminaria* is richer than *Fucus,* the common black weed of the rocks. Seaweed cut or thrown up in the early part of the year is richer than that obtained late in summer or autumn.

On the other hand, the foreign species gathered with the seaweed, *Zostera, Salicornia,* and *Glyceria,* are distinctly poorer in composition, and contain a certain amount of fibre that does not readily decompose. They are therefore of less fertilising value, as the practical man has already discovered. In Jersey, *Zostera* is gathered from the shallow sandy bays and heaped up in alternate layers with dung, but it is not usually applied direct to the land. Very thick, fleshy fronds of *Laminaria* may decompose so slowly in the soil that on light land they may do some harm by opening up the soil and drying it out.

The high manurial value of seaweed has already been pointed out. On the basis of the current unit values, the fertilising materials in 1 ton of fresh seaweed would cost about 10*s*., and in 1 ton of dried weed about 40*s*. to 65*s*. The amount obtainable must be enormous. Can it be better utilised than it is at present? This interesting question has not been overlooked by inventors, but the mechanical difficulties are so great that all attempts to make a saleable manure at remunerative prices have so far failed. The utilisation of the enormous quantities of fertilising materials thrown up every year by the sea on our shores still remains a problem for the future.

THE VALUE OF RECORDS OF THE MILK YIELD OF COWS.

The practice of keeping records of the quantity and quality of the milk yielded by dairy cows has made very great progress during recent years both on the Continent and also in the United States and Canada. It has also been adopted in this country by the leading breeders of pedigree cows, and to some extent by the more progressive farmers in the South of Scotland and in Lancashire.

The system is of value to the milk-seller, to the butter-maker, and to the breeder, according to the object for which the cows are kept. It enables the milk-seller to know exactly what yield his cows are giving and the quality of the milk given by each individual animal. He can thus identify cows

which systematically give a low yield or produce milk of low quality, and, by disposing of them, prevent the loss due to maintaining cows that are not worth their keep. Where milk is made into butter, the importance of obtaining a high percentage of fat in the milk is obvious, while to the breeder the practice of milk-testing is perhaps even more important, as by this means he can select his best cows for breeding purposes.

Simple Records of Milk Yields.—A record of the yield of milk in its simplest form is not difficult to keep, and the small amount of time and trouble involved is well repaid by the value of the information obtained. All that is required is a spring balance to which a pail can be hung. The milk of each cow can thus be easily weighed, and should then be noted on a sheet ruled for the purpose and fastened up in some convenient position. The weight of the pail should be deducted, but balances can be obtained with dials on which the weight of the pail is allowed for. If this record is kept systematically, an accurate account of the yield of each cow will be obtained. Its value lies in the fact that though in a general way farmers are able to distinguish between the good and bad milkers in their herds, a difference of 100 or even 200 gallons is not so easily appreciated when spread over the whole period of lactation. A difference of 100 gallons at $6\frac{1}{2}d.$ per gallon represents 54*s.*, and it is probably not too much to say that cows in the same herd frequently differ in their annual production by as much as £5 without their owner being aware of it.

If the trouble of weighing the milk of each cow daily is felt to be too great, an approximately accurate result can be obtained by doing it once a week, and multiplying the result by 7. Experiments made in Lancashire and in the United States have shown that the error is not likely to be more than 3 per cent.

Testing the Milk for Butter-fat.—Although a careful record of the milk yield is of considerable value, it is advisable that the milk-seller should also know the percentage of butter-fat in the milk of his cows. In the vast majority of cases the milk given by the cows of this country exceeds in butter-fat and other milk solids the percentage specified in the Sale

of Milk Regulations, 1901, made by the Board of Agriculture, but it may happen that certain cows in a herd may give milk which does not contain those percentages (3 per cent. of butter-fat and 8·5 per cent. of other milk solids). This is particularly liable to be the case where the milking is done at unequal intervals. The seller of milk containing less than these percentages runs a risk of being charged with a contravention of the Sale of Food and Drugs Acts. It is therefore of great importance to the milk-seller that he should inform himself by testing at regular intervals (about once a fortnight) whether the mixed milk of his cows is being maintained at a satisfactory level of quality. The morning and evening milking should be tested separately for this purpose. In the event of this mixed sample falling dangerously near the percentages mentioned in the Sale of Milk Regulations, he will need to take a sample of the milk of each cow in order to identify the cows which are giving milk of low quality. There is frequently great variation in the composition of the morning and evening milk from the same cow, but if no modification can be made in the hours of milking, the milk of a cow which systematically gives poor milk should not be sold unless mixed with a sufficient quantity of rich milk to bring it well above the limits referred to above. Experiments have shown that if a cow is well nourished, no alteration or improvement in feeding will permanently alter the quality of her milk.

Where milk is used for butter-making it is essential that the dairyman should see that all his cows are yielding milk with a high percentage of butter-fat, otherwise unless a very high price is obtained for the butter the value obtained for the milk is very low. For instance, 3·6 per cent. of fat in the milk is equal to a butter ratio of 1 : 25—that is, every 25 lb. of milk will produce one of butter; so that if the butter only fetches 1*s*. a pound, it represents less than 5*d*. a gallon for the milk. It is, therefore, of the highest importance to every butter-maker to see that each cow in the herd is producing milk of high quality.

Arrangements have been made with most of the Agricultural Colleges and Agricultural Departments of the Universities for determining the percentage of butter-fat for a fee of

6*d*. per sample. A list of these institutions and directions for sampling are given in Leaflet No. 146.

An important point in connection with these tests is the frequency with which they are required to be made in order to give an accurate indication of the average richness of the milk. Cows vary so much in the amount and quality of their milk from one milking to another that exact results cannot be obtained by testing the milk from one milking at distant intervals. There is little doubt that once a fortnight is sufficient, but if the sampling is only done monthly the error may be considerable.

The expense which would be incurred in sending a large number of samples regularly to the Colleges can, to some extent, be avoided by the testing being done at home by the Lister-Gerber testing apparatus, as after the first outlay the actual cost of making the test, apart from the labour involved, is insignificant. The use of this apparatus requires a certain amount of skill and care, but an intelligent dairyman or dairy-maid will become expert at it after a little practice.

Formation of Co-operative Societies for Milk-testing.—In order to avoid the trouble of milk-testing on a large scale, the Danes some years ago introduced the system of forming small societies of farmers, who combined in order to share the expense of employing an assistant to devote his whole time to the work.* This assistant visits each farm for one day in turn, and makes a careful record of the quantity and quality of the milk of each cow, and also of the system of feeding, and other particulars of the herd. The cost of this work in Denmark is not large, varying from 1*s*. to 2*s*. per cow annually. The assistant, usually a young man from an agricultural school, is paid only a small salary, as the position is regarded as affording an excellent training. The State also makes a small grant to the societies of about £14 each.

The statistics available of these societies in Denmark, Germany, and Sweden show that the average yield of the cows has substantially increased owing to the unsatisfactory animals being gradually discarded.

The great success which attended the efforts of these

* "Milk Testing and Control in Denmark," *Journal*, Vol. xii, April, 1905, p. 21.

societies has led to their establishment in other countries, but in Great Britain they have so far only been formed in the south-west of Scotland under the auspices of the Highland and Agricultural Society, which makes a grant towards the cost. These Scottish Associations are generally composed of twelve to eighteen members, each of whom has the milk from his cows weighed and tested, usually by a young man who has been trained in the Dairy School at Kilmarnock. He arrives at the farm during the afternoon, and weighs, samples, and tests for fat the milk of the evening and of the following morning, after which he goes on to the next farm. The weight of the food used is also ascertained, and some very interesting information as to the cost of food in the production of milk has been obtained. Thus it has been shown that the system of feeding adopted on some farms costs double as much as on others in proportion to the milk produced.*

Though these are the only British societies established up to the present, the Lancashire Education Committee have adopted the same system as a means of demonstrating how farmers can eliminate from their herds cows which produce milk of an inferior quality.

Value of Milk Records to the Dairy Farmer.—Apart from the benefits of the practice to the milk-seller and to the butter-maker, the keeping of milk records presents great advantages to the dairy farmer who breeds his own cows.

Milking qualities are largely hereditary, and the progeny of a heavy milking cow are likely to inherit the characteristics of their dam. It is therefore of the first importance that the dairy farmer should have a record of the performances of his cows, and should select the heavy milkers to breed from for his own herd. Dairy qualities are also transmitted through the bull, and it is equally important to be able to show that a bull is descended from a heavy milking strain.

The possession of a satisfactory milk record becomes in this way a very valuable asset, not only as a guide to breeding, but also for sale purposes. In Denmark the prices of dairy cows are in many instances regulated by their milking records.

* *Journal*, September, 1907, vol. xiv, No. 6.

This principle is well recognised in this country in the case of pedigree dairy cattle, but it is capable of a much wider application. By its aid it would be possible to build up a milking strain, the milk records of which would be equally as valuable as a pedigree. This point is mentioned in the Board's Handbook on British Breeds of Live Stock in connection with the non-pedigree Shorthorn, it being pointed out that:—

"Although one of the most serviceable and meritorious of all the numerous breeds of cattle in this country, this dairy breed remains under a cloud, especially with foreign buyers, because it has not got a paper pedigree. What it wants to make it of an inestimable value in the United States of America and the more temperate of our distant possessions is a pedigree of performance. The breed has been for a long time subjected to searching selection on the score of merit, and although no written record has been made of it, the record is there nevertheless in its capacity to produce heavy-milking progeny. It would consequently only require the recorded results of a few generations to provide evidence of merit in milking that would generally be transmissible."

It is from this point of view that the Milk Control Associations of Denmark have proved of the greatest service, and as many of them have now been in operation for upwards of fifteen years, a reliable and authentic life-history is available for several generations of the cows belonging to the herds tested. The owner of the herd can produce for the information of a purchaser a complete record, not only of the production of any particular cow, but of its dam as well, as evidence of the milking qualities which were likely to be transmitted through its sire. He is in possession, in short, of a "pedigree of performance" in regard to his particular strain of milking cows.†

There is little doubt that this system is worthy of imitation in this country, and could be fostered by breeding societies and local agricultural societies by means of small grants as in the case of the Highland and Agricultural Society.

* An account of the effect of these Societies on Cattle Breeding in Denmark appeared in this *Journal*, Vol. xvi, March, 1910, p. 1002.

IMPORTS OF THE CEREAL YEAR.

During the past cereal year (September 1st, 1909, to August 31st, 1910) the price of the three leading cereals, wheat, barley, and oats, has been lower than in the preceding year, though except for three weeks in June and one week in July the average price of British wheat, as ascertained under the Corn Returns Act, has kept above the 30*s*. level through the year. It has not, however, approximated to anything like the high figures reached in the preceding year, when the price was maintained at over 40*s*. per qr. for about four months. The average for the harvest year 1909–10 was 32*s*. 6*d*. per qr., or 4*s*. less than in 1908–9. The price of imported wheat, as indicated by the declared values, was 37*s*. 5*d*. per qr., as against 39*s*. 1*d*. in 1908–9. Imported wheat always stands at a somewhat higher level than the British average, and, as will be seen, the past year was no exception to this rule. This is probably due to the fact that the wheat on which the British average price is based contains a proportion of tail wheat, which is chiefly used for poultry, whereas the bulk of the imported wheat is of milling quality.

English barley averaged 23*s*. 10*d*. per qr., and oats 17*s*. 8*d*. per qr., both figures being below those of 1908–9.

The table below shows the average prices of British wheat, barley, and oats per quarter, as ascertained under the Corn Returns Act in each of the harvest years ending August 31st since 1898. The quantities given in the table are the quantities returned as sold, from which the averages are calculated:—

Harvest years.	Prices per quarter.			Quantities sold at certain markets.		
Sept. 1–Aug. 31	Wheat.	Barley.	Oats.	Wheat.	Barley.	Oats.
	s. *d*.	*s*. *d*.	*s*. *d*.	Quarters.	Quarters.	Quarters.
1898–99 ...	26 0	26 1	17 3	3,498,515	3,629,760	777,676
1899–1900...	26 4	25 2	17 4	3,255,654	3,355,241	722,859
1900–01 ...	27 1	25 0	18 1	2,463,341	3,109,149	684,956
1901–02 ...	28 4	25 11	20 4	2,451,275	3,176,599	698,840
1902–03 ...	26 5	23 4	17 8	2,386,017	3,151,337	1,104,660
1903–04 ...	27 2	21 10	16 4	2,129,448	2,780,473	1,132,086
1904–05 ...	30 7	24 6	17 0	1,746,927	3,141,058	1,178,154
1905–06 ...	28 9	24 2	18 5	2,940,263	3,202,613	940,015
1906–07 ...	28 1	24 5	18 4	2,830,991	3,376,615	1,219,419
1907–08 ...	32 9	25 8	18 2	2,944,256	3,564,908	1,530,848
1908–09 ...	36 6	26 11	18 10	2,962,825	2,972,889	1,054,318
1909–10 ...	32 6	23 10	17 8	3,144,873	2,988,483	795,824

The imports of wheat, which had shown no great variation during the preceding four years, took an upward turn during 1909–10, and reached a figure higher than in any year except 1904–5, though the receipts of wheat flour remained about the same. The home harvest of 1909 was, however, larger than for some years past, so that the total available for consumption in the United Kingdom, including seed, but exclusive of stocks carried over, was 35,500,000 qrs. This figure, as will be seen from the following table, is higher than in any recent year, and represents the maximum yet recorded.

Harvest Year.	Wheat Crop of the United Kingdom. Qrs.	Imports of Wheat during the Cereal Year Sept. 1—Aug. 31 Qrs.	Imports of Wheat Flour in equivalent Weight of Grain Qrs.	Total Wheat and Flour in equivalent Weight of Grain.	Total estimated Wheat Grain available for home consumption (including seed).
1902–3	7,284,800	19,861,990	6,215,630	26,077,620	33,362,420
1903–4	6,102,300	21,723,820	6,203,350	27,927,170	34,029,470
1904–5	4,740,000	24,529,170	3,526,620	28,055,790	32,795,790
1905–6	7,541,600	22,063,580	4,677,330	26,740,910	34,282,510
1906–7	7,577,300	22,105,180	4,284,490	26,389,670	33,966,970
1907–8	7,066,400	21,362,720	4,339,090	25,701,810	32,768,210
1908–9	6,741,200	21,727,220	3,554,650	25,281,870	32,023,070
1909–10	7,899,600	24,099,060	3,501,520	27,600,580	35,500,180

With regard to the countries contributing to the supply, the receipts from each of the principal sources are given below:—

Country of Export.	Thousands of cwts.			
	1909-10.	1908-9.	1907-8.	1906-7.
India	16,077	10,904	10,480	14,613
Russia	27,911	9,470	4,455	12,843
Argentina	11,405	24,542	28,128	22,179
United States	14,911	19,299	25,273	20,319
Canada	18,539	15,118	13,578	11,085
Australia...	11,915	9,587	6,264	7,769

The position of the countries contributing to our supply was materially altered during the past twelve months. The Argentine Republic, which had held the first place as the principal exporter for four years, was displaced by Russia, which sent a larger quantity than in any year since 1904–5. The second place, it is interesting to note, was taken for the first time by Canada, which furnished the maximum quantity yet received from that colony in any cereal year. The receipts from Australia were also relatively large.

FIG. 23.—GLUTINOUS AGARIC

(*Volvaria gloiocephala*).

As regards flour, the United States contributed 6,065,000 cwt., while Canada sent 2,818,000 cwt., a substantial advance on the 1,940,000 cwt. supplied in the preceding year.

The receipts of barley from abroad have shown no great variations in recent years, but the import of oats, which dropped to 10,900,000 cwt. in 1906–7, have since gradually increased to 19,600,000 cwt.

The imports of maize, on the other hand, were below those of the preceding year, and the lowest since 1894–5. Most of the decline is attributable to smaller supplies from Argentina (17,493,000 cwt., as against 21,423,000 cwt. in 1908–9), and the United States (5,363,000 cwt., as against 7,494,000 cwt. in 1908–9). Roumania sent 5,400,000 cwt.

Among the minor grains, 1,526,500 cwt. of peas and 2,006,000 cwt. of beans were received, as compared with 1,273,500 cwt. and 1,306,600 cwt. in 1908–9. The increase in beans is attributable to a recent development in the imports from China. Soy Beans are not included under this head.

The aggregate imports of the principal cereals in each of the past six years are given below:—

Harvest year.	Millions of cwts.				
	Wheat.	Wheat and Flour.	Barley.	Oats.	Maize.
1909–10	103·3	10·8	19·9	19·6	34·6
1908–9	93·1	11·0	22·0	15·5	39·0
1907–8	91·6	13·4	17·5	13·2	39·5
1906–7	94·7	13·2	19·5	10·9	51·7
1905–6	94·6	14·4	20·3	16·0	47·1
1904–5	105·1	10·9	21·0	17·2	42·3

POISONOUS VARIETIES OF FUNGI.*

GLUTINOUS AGARIC (*Volvaria gloiocephala*). (Fig. 23.)

The cap is 3 to 5 inches across, becoming almost flat with a central boss, dark smoky-grey, very glutinous; gills broad,

* This series of coloured plates and descriptions is completed by the three figures appearing this month. The previous numbers have appeared in the *Journal* as follows:—Nos. 1–3, February, 1910; Nos. 4–6, March, 1910; No. 7, February, 1909; Nos. 8–10, April, 1910; Nos. 11–13, May, 1910; Nos. 14–16, June, 1910; No. 17, September, 1908; Nos. 18–19, July, 1910; No. 20, November, 1908; Nos. 21–22, August, 1910. They can also be obtained in a volume, bound in paper covers, from the office of the Board, Whitehall Place, S.W.; price 1*s*., post free.

salmon-colour; stem elongated whitish, with a sheath or volva surrounding the base, 4 to 6 inches long, solid.

This fungus is found on the ground, on heaps of decaying leaves, &c., in summer and autumn.

It bears a general superficial resemblance to the Sheathed Agaric (*Amanitopsis vaginata,* Fig. 8), but is readily distinguished by the glutinous cap and the salmon-coloured gills.

VERDIGRIS AGARIC (*Stropharia aeruginosa*). (Fig. 24.)

When in vigorous growth the entire fungus is of a clear verdigris green colour. When growing in the open the cap bleaches as it becomes old to a pale dingy yellow colour. The cap is very glutinous, 2 to 3 inches across, stem scaly below the ring; gills becoming purple.

The most beautiful specimens occur in damp woods, amongst grass and bracken in summer and autumn. When growing in open places the bright colour soon disappears.

PURPLE AGARIC (*Cortinarius purpurascens*). (Fig. 25.)

Cap expanded and more or less wavy, purplish-bay, very glutinous, 4 to 5 inches across, flesh rather thick, clear blue; gills broad, rusty-coloured when mature; stem with a bulb at the base, solid, clear blue, about 3 inches long.

This is found on the ground in pine woods, &c., in autumn.

Care must be taken to distinguish between this and Blewits (Fig. 11), or the Amethyst Agaric (Fig. 13). In the Purple Agaric the distinctly swollen or bulbous base of the stem and the rusty gills are marked characters not present in the two edible kinds mentioned.

Strawberry Leaf-Spot.

Both cultivated and wild strawberries are often severely injured by a fungus called *Sphærella fragariæ,* Tul., better known in this country as *Ramularia Tulasnei,* Rab., a conidial form of the *Sphærella,* and for a long time the only known condition of the fungus. The foliage is the part attacked, and the symptoms are unmistakable. Small reddish-brown spots appear on the leaves; these often encroach on each other and form irregular patches. By degrees the centre of each patch assumes an ashy-grey or whitish colour, bounded by a reddish border, which becomes

FIG. 24.—VERDIGRIS AGARIC

(*Stropharia æruginosa*).

FIG. 25.—PURPLE AGARIC

(*Cortinarius purpurascens*).

Strawberry Leaf Spot (*Sphaerella fragariae*, Tul.).

bright red later in the season. This peculiar arrangement of a whitish spot bounded by a red ring has given origin to the local name of "Birds' Eye Spot" in some parts of the country (see Plate). The central whitish portion of the patch soon becomes studded with minute tufts of the conidial or *Ramularia* condition of the fungus. These continue to infect healthy leaves throughout the season. When the infected leaves begin to languish, the conidial condition is followed by the higher or *Sphærella* condition of the fungus, the spores of which remain on the dead leaves until the following spring, when they are liberated and infect the young leaves.

This pest is everywhere present in this country, and is also well known on the Continent and in the United States. None of the cultivated varieties escape the disease, but some are more severely attacked than others. The variety called "Royal Sovereign" is especially susceptible to the disease. When the injury is severe the crop of fruit is much reduced both in quantity and in quality; the plants are also weakened for the following season.

If spraying is commenced at a sufficiently early stage (in fact, where the disease has previously existed spraying should commence when the leaves are quite young) an epidemic may be prevented. The plants should be sprayed with a solution of potassium sulphide (liver of sulphur) in the proportion of one ounce to three gallons of water. This treatment will also arrest the possible appearance of Strawberry Mildew, *Sphærotheca humuli,* Burr. Spraying should be continued at intervals until the flowers begin to open.

The following method of combating the disease has proved highly satisfactory when strawberry beds are badly rusted. The beds should be mown soon after the fruit is gathered, covering the dry leaves with a sprinkling of straw or dry litter and burning them. This may seem harsh treatment for the plants, but everyone who has tried burning over a strawberry bed has been surprised by the vigorous and healthy appearance of the new foliage.

Notes on Insect and Fungus Pests.

Pests of Forest Trees.—The memorandum issued by the Board on the subject of the Large Larch Sawfly, to which reference was made in the issue of the JOURNAL for July, p. 316, produced a number of reports from the affected districts. The Board's Inspectors have also been engaged in searching suspected districts, and have discovered a number of cases of infested larch plantations which were not known to be attacked before. The pest has spread from the Welsh area into the Western counties of England, and has been recorded in Herefordshire. It is satisfactory, however, to be able to record that in several places the infestation is less serious than last year, especially in those plantations where remedial measures were attempted.

A number of other forest pests have also been reported, chiefly by the owners of the plantations. The Pine Sawfly (*Lophyrus pini*) has been found in the neighbourhood of Carlisle, in several places in Wales, and in West Scotland, as well as in Northumberland and Rutland. In some of the cases the trees affected were only a few feet high, and it seemed quite possible to pick or brush the caterpillars off the trees, and to drop them into buckets containing a little paraffin, or to jar them off the trees on to tarred sacks. The removal and destruction of the moss and litter under such trees in the autumn and winter would be advisable.

The Small Larch Sawfly (*Nematus laricis*) has been reported from Crieff (Perthshire) and Northumberland. In both cases it appeared to be doing some damage. Some of the caterpillars were found feeding well into August.

In three places reports were made to the Board that larch trees had been attacked by some pest, which, in one case at least, was supposed to be the *Nematus Erichsoni*. No caterpillars were found, but the shoots of the larch presented unmistakable signs of the presence of the grub of the Larch Shoot Moth, *Argyresthia* (Leaflet 208). As a result of more careful observation and search the Larch Shoot Moth is being found over a wide area in Britain. The *Argyresthia* attacks were reported from Midhurst in West Sussex, Wiveliscombe in Somerset, and Woodbridge in Suffolk. It

is interesting to note that in the last mentioned place the tits were said to have taken a large number of the larvæ from the infested shoots.

A sawfly found about thirty yards from a larch plantation near Auchterarder, Perthshire, was forwarded to the Board for examination, on the chance that it might prove a pest. It proved to be *Cimbex sylvarum*, the caterpillar of which feeds on birch in July, August and September. The body of the larva is green with a black stripe down the back, which, however, is bluish along the centre, and tapers at either end. The head is pale yellow, and the feet white with the claws brown. When young the larva is green-white and lacks the dark stripe on the back. It is of wide distribution in Great Britain and Europe.

On two occasions specimens of the Giant Wood Wasp (*Sirex gigas*) were submitted to the Board, once from North Wales, and once from South Scotland. In each case the "wasp" was supposed to be the Large Larch Sawfly. An account of this injurious insect was given in the Board's JOURNAL for May, 1907.

Specimens of willow leaves attacked by the Sawfly *Nematus gallicola* were sent from Glasgow. This insect is very common, and trees are very liable to reinfection. In the case of isolated trees the fallen galled leaves may be swept together in the autumn and burnt. The pupal stage of this *Nematus* may be passed in the soil or in crevices in the bark of the trees. While this is not a serious enemy, several pests attacking willows have been reported which have caused considerable damage during the past year. A crop of osiers in the neighbourhood of Stratford-on-Avon was seriously damaged by a *Cecidomyid* fly, which lays its eggs on the apices of the shoots. The larvæ on hatching attack the tips, so that the shoots fail to lengthen normally. The result is that several weak shoots break out, instead of the usual straight, healthy stems. The only treatment which can be recommended is the removal and destruction of the galls in which the brood lives. (See Leaflet 165.)

In another case some willows in the neighbourhood of Hampstead were found to be attacked, and one, at any rate, killed, by the caterpillars of the Goat Moth.

The most serious pest, however, reported to the Board as attacking willows has been the Beetle *Galerucella lineola.* This was referred to in the "Notes on Insect and Fungus Pests," published in the Board's JOURNAL for June, 1909, and notes were also published in the issues for July and November, 1908. This year the pest was recorded as having appeared near Bridgwater, and doing serious damage. An arsenate of lead spray would poison both the beetle and the grub, but a great difficulty is the want of co-ordination among the growers.

A pest scarcely less serious has been found in Hornchurch, Essex, namely, *Phyllodecta vitellinæ.* In this case an osier holt planted three years ago has been badly attacked. According to the owner's account, it was free the first year and only very slightly infested the second. The third attack was overwhelming. This beetle, about $\frac{1}{6}$ in. long, is of a bluish-black metallic colour and slightly iridescent, has rather long antennæ shaped like a string of beads. The eggs are laid in the spring on the leaves, which are skeletonised by the grubs which emerge. The adult beetle also eats the apices of the shoots and spoils their value, since lateral branches are thrown out which are not required. Spraying with arsenate of lead is efficient, both against adult and larva. It would save much damage and also considerable labour later on, both in the case of *G. lineola* and *P. vitellinæ,* if workers were sent round early in the season when the beetles are noticed on the plants, to shake the beetles off, before egg-laying, into jars containing paraffin.

Another insect sent to the Board was identified as a specimen of the Poplar or Willow Longicorn Beetle (*Saperda carcharias*). It came from Castle Hedingham, in Essex, a district where there are many willows. The beetle is yellow, brown or grey, and measures up to an inch and a quarter in length, exclusive of the antennæ. The females lay their eggs in cracks in the bark towards the base of the tree. The grub bores into the youngest wood, and hibernates there. When the next spring arrives the grub renews its feeding, and goes deeper into the wood, the galleries which it makes often reaching the centre of the tree. A second winter is passed in these galleries, but in the following summer,

Bacterial Disease of Ash Bark.

being full-fed, the larva pupates in a chamber, surrounded by bore-dust. It issues as a beetle in June, July or August. Plants up to 20 years of age are the most liable to attack. The best remedy is to reach the grub in the chamber with a piece of strong wire in the first stages of the attack, or by injecting bisulphide of carbon in more serious cases. Badly infested trees should be destroyed.

A correspondent from Guildford sent up a piece of oak bark, which was taken off an apparently healthy tree of some 100 to 120 years' standing. The inside contained a peculiar black substance which filled the interstices of the bark right down the tree, especially on one side. This black substance is a hardened gummy matter, which is mostly structureless towards the free surface. The origin can be traced partly to gummy degeneration of *fungus mycelium* growing on the bark, and partly, but to a less extent, to the same change in some of the tissues of the bark itself. Unfortunately, the primary cause of the disease could not be determined.

In the case of diseased ash bark from Banbury, the injury (see Plate) was due to a bacterial disease which most frequently occurs when the trees are growing in a damp, low situation. Excess of moisture causes minute cracks to appear on the stem, and the cracks are enlarged by frost, so affording an entrance for the bacteria, which eventually destroy the wood. The wounds should be cut out when small, and the surface protected with tar.

Report on the Prevention of Epizootic Abortion in Cattle.

The Departmental Committee on Epizootic Abortion were requested by the President of the Board of Agriculture and Fisheries, in a minute dated May 24th, 1909, to extend their inquiry so as to include a consideration of the administrative measures which should now be taken to deal with cases of this disease in cattle. The Committee have now presented a Report dealing with this aspect of the question (Cd. 5279, price 1*s*.).

The Committee received evidence from all the principal societies representative of cattle-breeding and dairying in Great Britain, which showed that the disease is sufficiently

serious, both in its aggregate effects and in the loss which it frequently occasions to individual stock-owners, to make it well worth while to oppose it by any reasonable measures of prevention that can be devised.

The disease has already established a very serious hold on the cattle stock in this country, and it is constantly being spread to new herds by the sale of infected cows. In this dispersal of the seeds of the disease it is possible that the principal part is played by cows that change hands soon after they have aborted, but a share in the spread of the disease, and possibly even the larger share, must be laid to the charge of cows that are infected but still pregnant and apparently healthy at the time when they are sold and introduced into healthy herds.

The possible methods by which the disease might be combated fall under two heads:—(1) private effort, and (2) public control.

Private Effort.—It is obvious that in the ordinary circumstances in which the cattle trade of this country is conducted, breeding or milking herds must as a rule be recruited by the purchase of cows or heifers without any real assurance that they have not been exposed to the risk of contagion, and in the absence of such an assurance the purchaser has no safeguard, since infected animals display no symptom by which their dangerous character can be recognised. Broadly speaking, therefore, private effort alone is foredoomed to failure as a means of preventing the spread of epizootic abortion. The Committee say that they cannot accept the suggestion that the existing state of affairs would be sensibly ameliorated if farmers were better informed regarding the pathology of the disease. They consider that the contagious nature of the disease is now very generally known to stock-owners, and evidence of this is furnished by the too common practice of immediately selling a cow that has aborted, and of exposing her for sale together with a calf falsely represented to be her own.

Public Control.—With regard to the need for public control, the Committee observe that public or State intervention with a view to prevention of a contagious disease appears to be justified when—

(1) It is recognised that private or individual effort as a means of combating the disease is from the nature of the case inadequate;

(2) Knowledge regarding the disease has reached such a point that it is possible to devise regulations which are likely to prove effectual if enforced by law;

(3) The weight of opinion amongst those whose interests are affected by the disease is in favour of State control;

(4) The loss occasioned by the disease when uncontrolled exceeds the probable cost of the measures required to counteract it.

The reasons for thinking that private effort is incapable of coping with epizootic abortion have already been given, and the Committee think that the second and third of the conditions necessary to justify State intervention exist in the case of epizootic abortion. The cause of the disease is now definitely known, and the difficulty of diagnosis would probably not be greater than it is in the case of some of the diseases already dealt with under the Diseases of Animals Acts. So far, therefore, as the question of diagnosis is concerned, it would appear to be quite practicable to compel notification of cases of abortion, and to arrive at a conclusive diagnosis as to the existence or otherwise of the disease in a contagious form.

As a complementary measure it would be necessary to prohibit for a time the free sale or movement of cows that have recently aborted. It is scarcely possible to doubt that this would have an important effect in preventing the further dissemination of the disease, but it would furnish only the minimum protection which the owners of healthy herds might reasonably expect, for there would still remain the risk attaching to the sale of in-contact pregnant cows from infected herds. Although it is not at present possible to say what part is played by the sale of infected but apparently healthy pregnant cows in the dissemination of the disease throughout the country, it is scarcely permissible to hope that it is a negligible part, or to expect that the disease could be stamped out by restrictions imposed only on cows that have actually aborted.

Under a plan of campaign which aimed at the early

eradication of epizootic abortion it would certainly be necessary to place restrictions on the pregnant animals known to have been exposed to risk of infection as well as on the cows that have actually aborted, but it would not be advisable to attempt to deal with the disease in that way at the outset. At first the admittedly less effective plan of placing restrictions only on the sale and movement of cows that have aborted would appear to be preferable, because the more drastic method would in many cases involve a heavy loss on the owners of infected herds, and probably would not receive the hearty support of owners in general. On the other hand, the evidence laid before the Committee tends to show that compulsory notification, and enforced temporary isolation of cows that have aborted, would be viewed with approval by the majority of stock-owners.

In order to decide whether any reported case of premature calving has been the result of infection or not, notification would have to be followed by a veterinary inquiry on behalf of the Local Authority for the purposes of the Diseases of Animals Acts. Such inquiry would not need to be repeated in the event of further cases of abortion occurring on premises upon which the disease has been found upon veterinary inquiry to exist within a period of less than three months from the date of the last reported case of premature calving, since it would be justifiable to infer that the later cases were due to contagion. It would, however, be open to the owner to produce satisfactory veterinary evidence that such was not the case, and thus to secure the withdrawal of the restrictions affecting such animals.

Such an arrangement would sensibly curtail the number of veterinary inquiries to be made on behalf of the Local Authority, and would materially reduce the cost of enforcing the restrictions without inflicting any undue hardship on the stock-owner. All that would be necessary would then be that a period should be fixed during which cases of premature calving occurring on infected premises should be regarded as cases of epizootic abortion without further veterinary inquiry on behalf of the Local Authority. Such period can only be fixed tentatively, but after a lapse of three months from the last case of abortion on any premises, the presump-

tion that any subsequent case of abortion was due to infection should not be maintained.

The Committee believe that these measures would be justified from an economic point of view. The annual loss of which epizootic abortion is now the cause must be enormous, and it appears to be certain that if the disease is allowed to run an uncontrolled course, as at present, it will become a still more serious plague.

In conclusion, the Committee recommend that, as a preliminary measure, epizootic abortion in cattle should be dealt with under an Order of the Board of Agriculture and Fisheries requiring—

(1) Compulsory notification of suspected cases of the disease;

(2) Veterinary inquiry to establish the existence of disease on any particular premises; and

(3) Temporary isolation and restrictions on the movement of any cow that has recently aborted.

In the event of effect being given to the above recommendations, such measures as may be thought necessary should be taken to avert the possible introduction of infection in cows imported into Great Britain from Ireland, the Channel Islands, or the Isle of Man.

Small Holdings and Agricultural Credit Societies.

A return [H.C. 166, price 1½*d.*] recently made to the House of Commons by the Registrar of Friendly Societies contains a memorandum, some extracts from which are given below, as to the varieties of land banks and societies registered to deal with small holdings and with loans for agricultural purposes:—

Credit Societies.—Agricultural Credit Societies, in which the members' liability is unlimited, are registered under the Friendly Societies Act, 1896, and the Special Authority granted by the Treasury, 16th May, 1876, or the substituted Special Authority of 23rd April, 1903. They are so constituted as to have the power of borrowing from non-members conferred by the Societies' Borrowing Powers Act, 1898 (Sir Horace Plunkett's Act). Thirty such societies exist in England and two in Wales. Nineteen are of recent formation,

having been registered since the beginning of 1908. Most of these societies were promoted by the Agricultural Organisation Society, Limited, and are auxiliary societies to Small Holdings and Allotment Societies. There are none in Scotland, but in Ireland societies of this nature are much more numerous than in any other portion of the United Kingdom.

Credit Banks.—A large number, probably many hundreds, of the societies registered under the Industrial and Provident Societies Acts, take power by their rules to carry on the business of banking; but most of them, it is believed, only carry on that business (if at all) to a very small extent and as auxiliary to other businesses. Those which appear to have been mainly engaged in the business of banking, at the close of 1908, are given in the list of financial businesses in Part B. of the Chief Registrar's Report for that year, and, so far as can be traced, comprised a group of 34 societies. Only two appear, by their names, to be in connection with land or agriculture, and these are situated, one in the City of London and one in Westminster; the latter is in connection with the Agricultural Organisation Society, Limited. In societies registered under these Acts the liability of the member is limited to the amount of his shares.

Land Societies.—This group comprises several old-established societies under the Industrial and Provident Societies Acts, which may be roughly described as societies for purchasing and developing land for re-sale to the members; the repayments being made to the society, and in some cases to the original vendor, by instalments. The land thus acquired is used principally for the erection of dwelling-houses, although, in some cases, it appears to be used for agricultural purposes, as small holdings and allotments.

Small Holdings and Allotments Societies.—This group, while composed mainly of societies formed to acquire land at a rental from local authorities, &c., includes a small number of older societies which have acquired land by purchase for small holdings and allotments.

At present in England and Wales 155 societies are established for the purpose of providing small holdings and allotments for their members. Of those registered at 31 December, 1908, 123 furnished returns of their operations, from which

it appears that in the aggregate 3,059 acres of land, having an annual value of £4,635, had been acquired for the purpose of small holdings by 13 societies; 797 acres as allotments, of an annual value of £1,611, by 20 societies; while grazing rights, &c., over 32 acres, valued at £66 per annum, were in the possession of two societies at the close of the year. The total number of tenants returned by the societies was 3,384. The above particulars may be considered as giving merely an approximation of the extent of the movement at the present time, many of the societies at the date of their returns being merely in an embryonic state of existence, and in process of negotiation for the acquisition of the land necessary to carry on their operations. In 89 societies the total paid-up share capital amounted to £5,083, while 19, principally old-established allotment societies in Northamptonshire, showed a total balance of profit and reserve of £1,092. The small holdings and allotments department of the above 123 societies received in rents £5,694, and in other income £1,141. Rents, rates, and taxes paid amounted to £5,240, and management expenses to £1,110.

Ordinary Co-operative Societies.—During recent years an important development has taken place in the "Housing" movement by co-operative societies engaged in industries and trades. "Building" departments have been established, and members enabled to acquire their houses by means of advances granted by the society on mortgages. In 1906 the amount so invested by societies in England and Wales amounted in the aggregate to 4¼ millions sterling, while 2½ millions sterling were then invested by societies in land and buildings other than used in trade. No information is available as to the extent to which land has been acquired (if any) for agricultural use by the members. Co-operative fruit farms and ordinary farms in some cases form an adjunct to a society's business.

Agricultural Co-operative Societies.—These societies, also registered under the Industrial and Provident Societies Act, are promoted in England and Wales principally by the Agricultural Organisation Society, Ltd., for the purpose of purchasing seeds, artificial manures, and other agricultural requisites at wholesale rates for the advantage of the members.

There are about 160 of these societies in England and Wales. In this group are also included Dairy, Poultry, and Egg Collecting Societies and societies for the sale of agricultural produce. The largest of these is the Eastern Counties Farmers' Co-operative Association (Reg. No. 4,122, Suffolk), whose sales in 1908 amounted to £212,753.

Agricultural, &c., Societies.—Societies for the promotion of agriculture, arboriculture, and horticulture can be registered under the Friendly Societies Act, 1896, and the Special Authority dated 23rd March, 1877, limitations revised 20th January, 1881, and the authority extended to arboriculture 9th January, 1907. Fourteen societies established under this authority are now upon the register. Of this number 10 societies are for the purpose of providing allotments for their members and one is a re-afforesting association. The remaining three are for the promotion of agriculture and horticulture in general terms. Four societies have upwards of 100 members. One society owns land valued at £964.

Cattle Insurance Societies.—Cattle Insurance Societies can be registered under the Friendly Societies Act, 1896, for the purpose of insurance against loss of neat cattle, sheep, lambs, swine, horses, and other animals by death from disease or otherwise. Only members of societies can effect insurances. The insurance may be to any amount. The liability of members is not limited, but practically the risks are small.

There are 61 societies at present on the register, distributed among the following counties:—Cambridge 2, Chester 1, Derby 3, Gloucester 6, Hertford 1, Huntingdon 1, Lancaster 2, Leicester 1, Lincoln 21, Northampton 2, Northumberland 3, Shropshire 6, Warwick 1, Wilts 2, Worcester 2, York 5, Flint 1, and the Channel Islands 1.

Two societies are for the insurance of horses only; 23 for neat cattle only; and 32 for swine only. Three societies insure horses and neat cattle, and 1 society insures neat cattle and swine.

Only 11 societies have a membership of 100 or upwards. Twenty-four societies have funds amounting to £100 or upwards; the two highest have £1,090 and £1,086 respectively.

SUMMARY OF AGRICULTURAL EXPERIMENTS.

EXPERIMENTS WITH CEREALS.*

Continuous Growing of Wheat and Barley (*Jour. Roy. Agric. Soc.*, Vol. 70, 1909).—This was the thirty-third year of the growth of wheat at the Woburn Experimental Station, and the third since certain changes were made in the system of manuring. The season was wet and sunless, and though a fortnight's fine weather was experienced in August, harvesting was much delayed by rain. Consequently the crop was secured in inferior condition, and the accuracy of the results, especially those relating to the straw, is less to be relied upon than in other years. Although the condition was bad the yield was better than might have been expected. On the unmanured plot it was $7\frac{3}{4}$ bushels per acre, with 8 cwt. of straw; the highest yield (27·8 bush. of corn and $33\frac{1}{2}$ cwt. of straw) was that on the plot which since 1907 has received farmyard manure supplying 100 lb. of ammonia per acre, while the next ($23\frac{1}{2}$ bush. of corn and 22 cwt. of straw) was that from 3 cwt. superphosphate, $\frac{1}{2}$ cwt. sulphate of potash, and sulphate of ammonia containing 25 lb. of ammonia. The last plot received one ton of lime in January, 1905. Nitrate of soda in this season appeared to result in the production of much tail corn and a low weight per bushel. With sulphate of ammonia alone the crop was, as usual in recent years, small or absent when no lime was given, but a fair one when not less than 10 cwt. of lime to the acre was applied. It is remarked that the influence of 2 tons per acre of lime, applied as far back as 1897, can still be traced, and sulphate of ammonia can still be applied with advantage.

Barley has been grown for the same number of years. This crop also suffered from the unfavourable weather, and the quality was very poor. The yield of the unmanured plot was 8 bush. per acre, and the highest, that with farmyard manure supplying 100 lb. of ammonia, was $45\frac{1}{2}$ bush. of corn with 37 cwt. of straw. Nitrate of soda (1 cwt.) alone gave only $14\frac{1}{2}$ bush. per acre, while another cwt. produced little more than an increase in straw, but where minerals (3 cwt. superphosphate and $\frac{1}{2}$ cwt. sulphate of potash) were used with 1 cwt. nitrate of soda, the crop was 27 bush. per acre. With sulphate of ammonia results similar to those of former years were obtained. Where it has been used, either alone or with minerals, without lime, there was hardly any crop.

Varieties of Oats, Barley, and Wheat (*Northumberland C.C., Bull.* 14, *Guide to Expts. at Cockle Park for* 1910).—Sixteen varieties of oats were grown in 1909, and the heaviest crops of grain were produced by Mounted Police, Blainslie, Banner, and White Giant. Taking

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* The summaries of agricultural experiments which have appeared in the present volume have been as follows:—Cereals, April; Cereals and Root Crops, May; Root Crops, June; Root Crops and Potatoes, July. The Board would be glad to receive for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

The present issue contains some additional experiments the reports of which were received too late to be included in the earlier summaries.

the average of the four years, 1906–9, Banner has ranked first with an average crop of 60¼ bush. (of 42 lb.) per acre, while Thousand Dollar comes second, and Sensation third, with 57 and 56½ bush. per acre respectively. The stiff-strawed oats, such as Storm King, have not given good results at Cockle Park, though on good soils and in less exposed positions they would probably do better.

In the barley trials, Archer, Chevalier, and Burton Malting did the best in 1909. Chevalier and Goldthorpe have now been grown at Cockle Park for seven years. In the first four years, 1903–6, Goldthorpe gave better crops than Chevalier, but in the last three years Chevalier has done the best in each year, so that in the seven years it has yielded an average of 43¾ bushels of grain and 29¾ cwt. of straw, against Goldthorpe's 43¼ bushels of grain and 28 cwt. of straw. Burton Malting has been grown for five years, and has given 44¼ bushels, while Maltster, during four years, has given an average of 47½ bushels. Both these are of the Goldthorpe type.

No advantage has been found in changing the seed of barley, the results from seed grown for a number of years at Cockle Park being as good as or better than those from seed brought from other districts.

Four varieties of wheat were grown in 1909, the yields of good grain being as follows:—Browick Grey Chaff, 40 bush.; Squarehead Master, 37¼ bush.; French Marvel, 36 bush.; Scholey's Squarehead, 35½ bush.

Experiments with Wheat, Oats, and Barley (*Field Expts. at Harper-Adams Agric. Coll., and in Staffs and Salop, Rept.*, 1909).—Trials were made in 1909 with fifteen varieties of wheat. The soil was a good loam, well suited to wheat, and the yields were, on the whole, satisfactory, all the crops standing well. The best yields (about 53 bush. per acre) were obtained from two varieties, called Garton's 3408 Red and Garton's 3608 White, which are not yet on the market. The next in yield were Browick Grey Chaff (50 and 51 bush.), Stand-up White (48 bush.), and Essex Conquerer (45 bush.). The first of these is considered to be the best wheat for the district of Shropshire; it has now been grown for four years, and the average yield has been 49¼ bushels per acre. All the seed grown at the College has been supplied to farmers, and growers have also sold their seed, so that the acreage under this variety is now very considerable.

Two French varieties, Marvel and Sensation, were sown as spring wheats, and produced yields of 41 and 36 bushels respectively, while the straw was superior to that of other varieties, and very little rust was observed. A further trial will be made with them, sown in the autumn.

Three Fife wheats were grown, and produced crops of from 36 to 45 bushels. One of these wheats took the first prize at the Newport Show. The milling and baking qualities of these wheats and of Browick Grey Chaff and Stand-up White were tested, and photographs are given of the loaves made, showing the marked difference in the strength and quality of different varieties. A report on the grain and straw of each variety is given, with a valuation of samples by a firm of millers.

The varieties of oats were grown on a heavy loam, in good condition. They suffered from frit-fly, but were helped to recover by rain

in June and July. New White Horse, Stable King, and Mounted Police gave yields of over 80 bushels per acre, but the quality of each was somewhat inferior to that of Thousand Dollar and Abundance, which gave crops of over 70 bushels. The effect of a change of seed was tested. Five varieties have now been grown for from four to six years, and the following have been the average yields of these:—New White Horse, 75 bush.; Thousand Dollar, 74 bush.; New Abundance, 72 bush.; Waverley, 70 bush.; Newmarket, 64½ bush.

An experiment on barley was begun in 1909 to test the effect of a complete dressing of artificial fertilisers, and to compare potassic superphosphate with a mixture of kainit and superphosphate, and nitrate of lime with sulphate of ammonia and nitrate of soda. The results at present are considered to show the necessity for a complete manure, the omission of potash or nitrogen materially reducing the crop.

Manuring of Wheat (*Wilts C.C. Agric. Educ. Com., Results of Field Manurial Demonstrations,* 1908–9).—Experiments were carried out at three centres in the county. There were eight plots of 12 perches ($\frac{3}{40}$ acre) at each centre, and the following scheme of manuring was adopted:—One plot was not manured; one plot received a dressing of kainit, superphosphate, and nitrate of soda; three plots received two of these manures, and three received the single manures. In all cases the quantities of the manures applied were:—Kainit, 2⅛ cwt.; superphosphate, 3 cwt.; nitrate of soda, 1¾ cwt.

Taking the average of the three centres, the complete dressing produced an increase in the grain crop of nearly 10 bushels per acre, which results in a profit, after deducting the cost of the manures, of 23*s.* per acre. Kainit and nitrate of soda did almost as well, the increase being over 9 bushels, and owing to the smaller cost of the manures the gain was 24*s.* 6*d.* per acre. The straw on this plot was also almost equal to that of the complete manure plot. Kainit alone gave a large increase at two centres.

Experiments with Wheat and Oats (*Midland Agric. and Dairy Coll., Rept. on Expts. with Crops and Stock,* 1908–9, *and Do.* 1909–10).—Three French varieties of wheat—Steadfast, Marvel, and Sensation—were tried against Browick Grey Chaff and Carter's White Stand-up. The plots were about one acre each. In the spring the French varieties looked weak, with little promise of "tillering," and up till harvest they appeared to have little to recommend them. All three, however, gave a better yield than either of the English wheats, the average being nearly 6½ qrs. per acre, while that of the two English varieties was 5¾ qrs. They appeared to be rather more susceptible to "smut" than the standard English varieties, and none of them were quite as good for milling purposes.

A trial of some varieties of oats new to the Midlands was carried out in 1908 on seven farms, and in 1909 on five farms. Abundance was selected as the standard variety with which they were compared. In 1908 Abundance was exceeded by all the other varieties, viz.:—Mounted Police, Thousand Dollar, Wide Awake, Hvitling, and Propsteier, the difference in the produce of grain and straw being valued at about £1 per acre. In 1909 Propsteier and White Horse were first with a yield of 54⅗ bush. per acre each, Abundance produced

$53\frac{2}{3}$ bush., and Thousand Dollar and Mounted Police produced 53 bush. Thousand Dollar was the best sample and Mounted Police the worst.

A small trial was made at four centres in 1908 for the purpose of demonstrating whether the oat crop can be profitably treated with artificial manures. The land was in good "heart" at all the centres, at three of which clover was the previous crop. All the dressings produced an increase in the crop, more than enough to pay for the manures, the best result being that from $\frac{3}{4}$ cwt. sulphate of ammonia alone, which gave an increase of 37 stones of grain and 6 cwt. of straw, or a value of 34*s.*, after deducting the cost of the manure.

Varieties of Oats and Barley (*Aberdeen and N. of Scotland Coll. of Agric., Expts., Leaflet No.* 10).—Six varieties of oats were tested against the common Potato strain at fourteen centres. The plots were one-tenth acre in extent, and the seed was sown at the rate of $3\frac{1}{4}$ million grains (7–$8\frac{1}{2}$ bushels) per acre, except in the case of Potato, which, owing to its habits of stooling or tillering, was considered sufficiently thick at the rate of three million grains per acre. The season, being cold and late, was more favourable to the hardy Scotch varieties than to the more tender kinds recently introduced. Nevertheless the newer varieties continued to show a marked superiority in crop. From various causes the results from only eight centres were considered trustworthy, and, taking the average of these, the following yields in bushels per acre were obtained:—Major, 76; Banner, 73; Thousand Dollar, 72; White Horse, 70; Yielder, 70; Potato, 67; and Bountiful, 66. Major is the produce of a mixture, made locally in 1905, of Waverley, Wide Awake, Siberian, and Thousand Dollar. The produce of this mixture has been grown each year since, and has been noteworthy for its heavy and uniform crops. The earliest variety was Yielder, which ripened from a week to a fortnight before Potato.

A series of preliminary experiments have been carried out to ascertain whether there is a probability of increasing the barley produce of the north of Scotland by the introduction of superior varieties. Six varieties were tested in 1909 in comparison with Common Barley and St. Madoes, an old Perthshire variety. Plots of one-tenth acre were sown on twelve farms at the rate of $2\frac{1}{4}$ million grains per acre, or about $4\frac{3}{4}$ bushels per acre of Common Barley. The following are the average crops of dressed grain in bushels per acre at eight centres (the results from the other four centres were not considered reliable):—Invincible, 47; Danish Archer, 45; Maltster, 44; St. Madoes, 42; Goldthorpe, 42; Common, 41; Chevalier, 39; Eclipse, 37. Danish Archer is considered to be the most valuable variety for the better barley districts, but it is not suitable for cold or high land. It produces a large quantity of straw as well as a heavy grain crop, and during the three years for which these trials have lasted has each year given the greatest total yield of grain and straw together.

Varieties of Wheat and Oats (*Holmes Chapel Coll. of Agric., Year-Book,* 1909).—Of ten wheats, White Stand-up and Red Stand-up gave the heaviest yields of both grain and straw. Of eight varieties of oats Thousand Dollar, Tartar King, and Triumph White, which were all about equal, did best.

Time of Sowing of Red Fife Wheat (*Jour. South-Eastern Agric. Coll., No.* 18, 1909).—A trial was made of the effect of early and late

sowing on the quality of Red Fife wheat. The grain was milled and baked, and the opinion of the millers was that February, March, or April sowing seemed to make no difference in the value of the flour. The superiority of Fife wheat to English wheat was estimated by them to be in the proportion of 88 to 68.

EXPERIMENTS IN IRELAND.

Prevention of Braxy and Louping Ill in Sheep (*Jour. Dept. of Agric. and Tech. Instruc. for Ireland,* October, 1909).—The Report of the Departmental Committee on Louping Ill and Braxy (see *Journal,* June, 1906, p. 135) contained a full account of their investigations into these diseases, and pointed out that they appeared to belong to a group of bacterial diseases with a peculiar characteristic. If the bacilli gain access to sheep during a particular season of the year they multiply and cause the death of the animals, but during the summer, and to a less extent at other seasons of the year, they are destroyed by the blood of the sheep, and no disease is produced. These latter animals are in this way rendered immune, so that when the period of danger arrives they fail to take the disease. It was suggested that sheep could be protected against the disease by the administration of doses of the bacilli during the period when they are immune to them, and as the organisms are usually picked up by the sheep when grazing they were introduced by "drenching." A number of sheep were treated in this way with very satisfactory results.

The Irish Department of Agriculture in 1906 began a series of tests of the preventive method, continuing the experiments during 1907 and 1909. The experiments had unavoidably to be discontinued in 1908, owing to the illness and subsequent death of Dr. Hamilton, the discoverer of the treatment.

The Department were extremely fortunate in obtaining the active co-operation of many sheep owners, and great interest was aroused. No final conclusion as to the value of the method has yet been arrived at, though it is hoped that the results of last season's experiments will warrant such a conclusion.

The method adopted in the experiments is briefly as follows:—For the prevention of braxy, a small quantity of pure culture of the germs of the disease, in peptonised beef-tea, was administered as a drench to each lamb in the month of August, *i.e.,* towards the end of the period when sheep are immune to the disease. A similar drench is used in the case of louping ill. Certain districts were selected where serious losses occur annually from the diseases, and a number of flocks were drenched, each animal being afterwards marked. On a death occurring among the drenched sheep a small quantity of the peritoneal fluid was dispatched to the laboratory for microscopic examination, to ascertain whether the animal had died from one of these diseases. Considerable difficulty was naturally experienced in ascertaining the cause of deaths in flocks roaming over mountain areas, and some sheep that probably died from other causes have been included in the mortality from braxy and louping ill owing to carcasses being found too long after death for certain diagnosis.

The total number of sheep drenched in 1906 was 848, and of these 13, or 1·5 per cent., died from braxy and louping ill. In 1907 4,276

sheep were drenched, and the mortality from the disease was 200, or 4·6 per cent. It is stated that the season of 1907–8 was an unusually bad one as regards these diseases, the losses among undrenched sheep in Co. Wicklow averaging about 15 per cent., and in some cases going as high as 50 per cent. On two farms where absolutely reliable accounts of the deaths among drenched and undrenched sheep could be obtained, the mortality among the former from braxy was 2·5 per cent., and among the latter 13·77 per cent.

As regards louping ill, the treatment was not always so successful. On one farm, out of 246 ewes drenched, only five died before the new year, an enormous reduction in the usual mortality, while with the advent of the louping-ill season the mortality became serious, and 37 died before the end of winter. Dr. Hamilton found that a second drenching later in the year than August was desirable for louping ill, and these experiments also suggest that this may be necessary.

Value of Liquid Manure (*Jour. Dept. of Agric. and Tech. Instruc. for Ireland, April,* 1910).—It is generally agreed that a great waste of fertilising material takes place in this country owing to the small use made of liquid manure, yet great difference of opinion exists as to whether it pays to cart it out. Some experiments have recently been carried out by the Irish Department of Agriculture to determine its value in comparison with farmyard manure and artificials, and to ascertain whether the increase of crop produced would repay the cost of carting the liquid manure. Four plots of ¼ acre each in an old meadow that had grown hay for six years previously with artificial manure alone were selected. One plot was untreated, one received 21 tons of liquid manure per acre, half in the first week in February and half in the last week in April, one received 16 tons of farmyard manure, and the fourth plot 1 cwt. nitrate of soda, 3 cwt. superphosphate (30 per cent. phosphate), and 2 cwt. kainit. The experimental plots were about 650 yards from the liquid manure tank. The liquid manure was conveyed to the field in a 100-gallon oil barrel fixed on the wheels, axle and shafts of an old cart. Distribution was effected by means of a V-shaped trough attached to the end of the cart and perforated with a number of holes to spread the liquid. In the year in which the manures were applied the increase in crop on the manured plots over the unmanured plot was :—Liquid manure, 1 ton 6 cwt. per acre; farmyard manure, 16 cwt.; artificials, 17 cwt. The next year the plots were left untreated, and the increases due to the residue of the manures in the soil were respectively, liquid manure, 7½ cwt. per acre, farmyard manure, 11½ cwt.; and artificials, 1½ cwt. The total increases were thus :—Liquid manure, 1 ton 13½ cwt. per acre; farmyard manure, 1 ton 7½ cwt.; artificials, 18½ cwt. As was to be expected, the residual value of the liquid manure, as shown by the crop in the second year of the trial, was less than that of the farmyard manure. The artificials appear to have been exhausted in the first year.

An attempt is made in the report of this experiment to estimate the profitableness or otherwise of the applications. The increase in the crop of hay produced is valued at £2 per ton, and at this rate each ton of liquid manure used gave a return of 3*s.* 2*d.*, while the return from the farmyard manure was 3*s.* 5*d.* Valuing the hay at £3 per ton, these amounts would be 4*s.* 9*d.* and 5*s.* 1*d.* respectively. As regards

the cost of application, it was found that a man and horse could distribute on the experimental field, 650 yards from the tank, about 20 cart loads, or 9 tons, of liquid manure in a working day of ten hours, at a cost of 8*d.* per ton. In this estimate, however, only the carting is taken into consideration, and as on most farms no provision exists at present for collecting and storing liquid manure, the cost would be increased by the provision of a suitable tank. It must also be remembered that, while a considerable proportion of the liquid manure is under the usual conditions wasted by drainage from the dung heap, a large quantity is absorbed by the litter, and a part of the liquid collected in the tank would have been utilised with the farmyard manure.

A second series of hay plots was started in 1909, on which the liquid manure was applied in the same quantity (16 tons per acre) as the farmyard manure, and in this case both gave an increase in crop of 15 cwt. per acre, that from the dressing of artificials being 7 cwt. From the appearance of the plots, however, the farmyard manure is likely to give the better return in the second year. The returns obtained from the manures in this experiment were not high, but it is stated that the field was already in a high state of fertility, the crop on the unmanured plot being 3 tons per acre.

An experiment was also started in 1909 to compare the value of liquid manure and farmyard manure on arable land. Mangolds and cabbages were manured with (1) 25 tons liquid manure, and (2) 20 tons farmyard manure. Other plots received the same with, in addition, a dressing of a complete mixture of artificials. The results showed that where artificials were used in conjunction practically the same yields were produced with the liquid as with the farmyard manure, while on the plots to which no artificials were applied the crop with liquid manure was the smaller by about 2 tons. In this case one-third of the liquid manure was applied in December, one-third when the drills were opened, and one-third after thinning, and there can be no doubt that a considerable proportion of the liquid applied in December would be washed away. This loss cannot, however, be entirely avoided, since sufficient storage capacity cannot be provided to hold over all the liquid until the spring.

Liquid manure necessarily varies in composition according to the feeding of the cattle and the quantity of water that finds its way into the tank, but its value in these experiments appears to show that the question of its storage and use is worthy of consideration.

Trials with Four Nitrogenous Manures (*Jour. Dept. of Agric. and Tech. Instruc. for Ireland,* January, 1910).—In 1909 a comparison was made by the Irish Department of Agriculture of the two new nitrogenous manures, calcium cyanamide and nitrate of lime, with the two older sources of nitrogen, nitrate of soda and sulphate of ammonia. The crops on which these manures were tested were oats, potatoes, turnips, and mangolds, four plots being dressed with one each of the four nitrogenous manures, and a fifth plot receiving no nitrogen. Other artificial manures supplying phosphates and potash were applied, and in the case of some crops farmyard manure, but in each series the cultivation and manuring of each of the five plots was the same, except as regards the source of nitrogen. The percentages of nitrogen in the manures used at most of the centres were as follows:—Sulphate of

ammonia, 19·75; nitrate of soda, 15·5; calcium cyanamide, 20·0; nitrate of lime, 13·0; and consequently, in order that the same amount of nitrogen might be applied to each plot, the following quantities of the manures were used:—Sulphate of ammonia, 1 cwt.; nitrate of soda, 1⅓ cwt.; calcium cyanamide, 1 cwt.; nitrate of lime, 1½ cwt. For the mangold crop double these quantities were used. The results obtained with each crop are shown in the following table:—

Manure.	Oats.			Potatoes.		Turnips.		Mangolds.	
	Grain.		Straw.						
	cwt.	qrs.	cwt.	tons	cwt.	tons	cwt.	tons	cwt.
Sulphate of ammonia ..	26	2	47	12	6	25	3	32	10
Nitrate of soda	25	2	50	12	2	26	6	31	14
Calcium cyanamide ...	27	0	44	12	15	26	3	30	3
Nitrate of lime	27	0	48	12	10	24	17	32	17
No nitrogenous manure	24	1	41	11	10	23	11	25	9

The trials on oats were made at five centres, on potatoes at ten centres, on turnips at four centres, and on mangolds at eight centres.

These results appear to show that the two new nitrogenous manures are not inferior to the two already in general use. There is not much difference in yield with any of the crops, and nitrogen in each of the forms appears to give equally good results.

In choosing which of the manures to use, the cost per unit of nitrogen contained in each should be considered, and its convenience in handling. Nitrate of lime is usually delivered in casks, and if exposed to the air absorbs moisture and quickly becomes wet. It is not, therefore, suitable for mixing with other manures. Calcium cyanamide is a very fine powder, and should be stored in a dry place. It is unpleasant to sow by hand.

OFFICIAL CIRCULARS AND NOTICES.

The Board have addressed the following Circular, dated August 15th, to County Councils and Councils of County Boroughs in England and Wales, on the subject of the payment of Compensation for the termination of a tenancy of land under the Small Holdings Act, 1910:—

Small Holdings Act: Compensation for Termination of Tenancy.

SIR,—I am directed by the Board of Agriculture and Fisheries to call your attention to the provisions of the Small Holdings Act, 1910, which came into operation on the 3rd instant.

Section 1 of the Act is as follows:—

1.—(1) Where a council, or a landlord at the request of a council, terminates a tenancy of land by notice to quit, with a view to the use of the land or any part thereof by the council for the provision of small holdings, the tenant upon quitting shall be entitled to recover from the council compensation for the loss or expense directly attributable to the quitting which the tenant may unavoidably incur upon or in con-

nection with the sale or removal of his household goods or his implements of husbandry, produce, or farm stock on or used in connection with the land:

Provided that no compensation under this section shall be payable—

(*a*) unless the tenant has given to the council a reasonable opportunity of making a valuation of such goods, implements, produce, and stock as aforesaid; or

(*b*) If the claim for compensation is not made within three months after the time at which the tenant quits.

In the event of any difference arising as to any matter under this section the difference shall, in default of agreement, be settled by arbitration.

(2) The Board of Agriculture and Fisheries shall, out of the Small Holdings Account, repay to a council any compensation paid by the council under an award or with the consent or approval of the Board, and also any expenses which, in the opinion of the Board, have been necessarily or reasonably incurred by the council in relation to any claim for compensation under this section.

(3) This section shall apply where a tenancy is terminated after the commencement of this Act, whether the notice to quit is given before or after such commencement.

In view of the fact that compensation paid under ths section will be repaid to the Council out of the Small Holdings Account the Board desire to indicate the procedure that in their opinion should be followed in dealing with claims.

The Council should in all cases avail themselves of the opportunity which must be afforded by the tenant of making a valuation of the household goods, implements of husbandry, produce or farm stock proposed to be sold or removed, and for this purpose should make arrangements which will secure the prompt inspection of the goods, &c., by a valuer or other qualified person. The time for doing this before the sale or removal may be insufficient to enable the matter to be brought before the Council or their Committee, and an officer of the Council should therefore be authorised to make the necessary arrangements as occasions arise.

If the tenant has satisfied the condition set out in paragraph (*a*) the actual claim will be in time if it is made within three calendar months after the time at which the tenant quits. The Board do not think it is essential that the claim should include all particulars or state the total amount claimed, but the Council should ask for this information, and in case of refusal they should warn the tenant that the refusal may affect the costs of any arbitration that may be necessary (*see* Small Holdings and Allotments Act, 1908, section 58 (1) and Agricultural Holdings Act, 1908, Second Schedule, paragraph 15).

If the Council, on investigating the claim, are satisfied that the amount claimed is reasonable, or if they propose to offer a sum in settlement, they should in the first instance inform the Board of their views and supply all information bearing on the question necessary to enable the Board to determine whether their consent should be given. If the Council think that the matter should go to arbitration, they should either try and agree with the tenant upon an arbitrator by submitting to him the names of two or more arbitrators to whose

appointment they would assent, or they may at once apply to the Board to appoint an arbitrator.

Compensation under the Act is only payable where the tenancy is terminated by a notice to quit, and will, therefore, not be payable where the tenancy is terminated (*a*) by arrangement with the tenant, or (*b*) by its acquisition or extinguishment under the procedure for compulsory acquisition. In the latter case compensation is payable under the Lands Clauses Acts as modified by the Small Holdings and Allotments Act, 1908.

Section 2 of the Act is as follows:—

Where a tenancy has been terminated before the commencement of this Act, and the tenant proves to the satisfaction of the Board of Agriculture and Fisheries that he has incurred any loss or expense for which he would have been entitled to compensation under the foregoing section of this Act if the tenancy had terminated after the commencement of this Act, the Board may, out of the Small Holdings Account, pay to the tenant such compensation for such loss or expense as they think just: Provided that no compensation under this section shall be payable if the claim for compensation is not made before the first day of November nineteen hundred and ten.

The Board would be glad if you would at once take steps to bring this provision to the notice of all persons who may be entitled to make a claim thereunder in respect of tenancies terminated in your County. The claim must be sent to the Board before the 1st November next, but the amount and detailed particulars of the claim may be submitted subsequently. If any such claim is received by a council the tenant should be referred to the Board.

I am to add that the Board are of opinion that in order to avoid any question in the future as to whether or not a notice to quit has been given by a landlord at the request of the Council, the officers of the Council should be instructed that no such request should be made except in writing and upon express instructions from the Council or the Small Holdings and Allotments Committee.

I am, &c.,
T. H. ELLIOTT,
Secretary.

Report on Prices and Supplies of Agricultural Commodities.

The volume of Agricultural Statistics for 1909, containing information relating to the prices of agricultural produce, the supplies of live stock, and the imports and exports of agricultural commodities, has now been published (Agricultural Statistics, 1909, Part III., Cd. 5268, price 9*d*.). The tables are prefaced by a Report by Mr. R. H. Rew, dealing with the fluctuations in prices and supplies.

MISCELLANEOUS NOTES.

Importation Regulations.

Importation of Pine and Fir Seed into Sweden.—By a Royal Decree of 4th April, 1910, foreign seed of all sorts of pine (*Pinus*), except *Pinus cembra* and *Pinus sibirica*, and all sorts of fir (*Picea*), may only be imported in sacks clearly marked "utländskt frö" (foreign seed), and must be treated with a solution of "eosin" in the manner prescribed by the decree. This is for the purpose of dyeing the seed to make it easily recognisable.

Disinfection of Hides Imported into the United States.—The United States Treasury Department have issued revised regulations governing the disinfection of hides of neat cattle imported into the United States, which supersede those prescribed by Circular No. 52 of 20th October, 1909 (see *Journal*, December, 1909, p. 764). The revised Regulations may be inspected on application at the Office of the Board, 8 Whitehall Place, S.W.

Importation of Bees, &c., into South African Protectorates.—Restrictions are placed upon the importation of bees, used beehives, &c., into Basutoland, Swaziland, and the Bechuanaland Protectorate by Proclamations Nos. 15, 16, and 17 respectively of 1910 of the High Commissioner for South Africa. The importation of honey, beeswax, used beehives, and used beehive accessories or appliances is prohibited, and the consent of the Resident Commissioner must in each case be obtained before importation of bees.

Importation of Plants into Canada.—By the Destructive Insects and Pests Act (Canada) and regulations under the Act nursery stock, including trees, shrubs, plants, vines, grafts, scions, cuttings, and buds, may be imported into Canada only through the following ports and during the following periods:—Vancouver, British Columbia, and Niagara Falls, Ontario, from October 1st to May 1st; Winnipeg, Manitoba, and St. John, New Brunswick, from March 15th to May 15th, and from September 26th to December 7th. Any nursery stock or other vegetable matter infested with any of the following insects and diseases will be destroyed, together with the cases, &c., in which it is contained:—San José Scale (*Aspidiotus perniciosus*), Brown-Tail Moth (*Euproctis chrysorrhœa*), Woolly Aphis (*Schizoneura lanigera*), West Indian Peach Scale (*Aulacaspis pentagona*), Gypsy Moth (*Porthetria dispar*), Potato Canker (*Chrysophlyctis endobiotica*), parasitic diseases affecting potatoes externally or internally, Branch or Stem Canker (*Nectria ditissima*), Gooseberry Mildew (*Sphœrotheca mors-uvæ*), White Pine Blister Rust (*Peridermium strobi*). In certain cases provision is made for the fumigation of nursery stock entering these ports, but such stock originating in Europe is exempt from fumigation, and may be inspected on arrival at its destination instead of at the port. Compensation up to two-thirds of the value of vegetation, cases, &c., destroyed will be granted on the recommendation of the Minister of Agriculture.

In addition, regulations of the Board of Horticulture of British Columbia, dated March 16th, 1909, provide that all nursery stock, trees, and plants imported into British Columbia shall be delivered

at the Provincial Disinfecting Station in Vancouver, to be inspected, and if they are infested with any insect pest or fungus disease, to be disinfected or destroyed.

Nursery stock imported into Nova Scotia must be passed by the Inspector under the "San José Scale Act," 61 Vic. cap. 24, of March 11th, 1898, of Nova Scotia, and if found to be infested with the scale will be destroyed.

Importation of Plants and Potatoes into Natal.—Government Notice No. 289 of 1910, dated May 19th (*Natal Government Gazette,* May 24th, 1910), contains additional regulations for the entry of plants into Natal otherwise than through the post, and special conditions to be observed in the importation of potatoes. The regulations provide for the payment of fees for examination and fumigation.

Importation of Live Stock into France.—The Board of Agriculture and Fisheries desire to give publicity to the fact that under new regulations which have been made by the French Government respecting the importation of horses, cattle, sheep, goats, and pigs from the United Kingdom into France, the certificate of the Board as to the freedom of the locality from contagious disease has been substituted for the certificate of the Local Authority. Intending exporters of live stock to France should therefore make application to the Board for forms of application for certificates and for instructions as to the information required before the certificate can be issued.

Importation of Cattle into Argentina.—The Board of Agriculture and Fisheries have received telegraphic information from Buenos Aires confirming the publication of the Argentine Decree prohibiting the importation of cattle from England, in consequence of the recent outbreak of foot-and-mouth disease in Yorkshire. This restriction does not apply to Scotland or Ireland, and certificates can therefore be issued in respect of cattle, sheep, or swine, which have been in either country since July 20th last, if shipped direct from a Scotch or Irish port.

Demand for Agricultural Machinery Abroad.

Agricultural Machinery in Russia.—The *Board of Trade Journal* (August 4th, 1910) contains extracts from Consular Reports, dealing with the agricultural machinery industry. Particulars are given of the amount of machinery imported into Russia from various countries and statistics of the home production. The number of factories is stated to be 340, and the output in 1908 was valued at £3,500,000. There was a development in the agricultural machinery business, both as regards imports and home manufactures during 1909. The *Board of Trade Journal* for August 11th contains information as to the terms of payment which prevail, in which it is pointed out that German manufacturers have a great advantage over British firms in the agricultural machinery market on account of the ease with which the former can obtain the use of money, German banks offering greater facilities in discounting bills. This enables the German dealer to offer more acceptable terms, and he thus gets a better price for his machine than does his British rival. To do this kind of business with success the manufacturer must be in close touch with his customers, far closer than the British manufacturer usually is with his.

It is generally acknowledged that the British steam threshing

machinery is superior to the German, but comparing weight with weight or size with size (since the denomination of the sets varies) the customers pay for the German sets about 5 per cent. more than for the British, simply because of the easier terms of payment. In fact, competition in steam threshing machines has become largely a question of finance.

Notes on Agriculture Abroad.

Opening for Agricultural Seeds in Poland.—H.M. Consul at Warsaw (Mr. C. Clive Bayley) reports that a Polish agricultural syndicate desire to obtain the representation of British firms exporting the following agricultural seeds:—beet, carrot, turnip, wurzel, maize (horse tooth), oats, barley, field and meadow grasses, lucernes. An agency for garden, vegetable, or flower seeds is not required. The syndicate would be glad to have catalogues and price lists.

Communications in this connection should be addressed to the British Consulate, Warsaw.

Budget of the French Ministry of Agriculture.—The total amount voted in the Budget of the French Ministry for the year 1910 was £1,986,347, or an increase of £55,387 over the amount in 1909. The main items are:

	£
Salary of Minister and staff	46,440
Grants in aid of farmers and subventions to agriculture	121,600
Bounties given for the cultivation of—	
Silkworms	200,000
Hemp	91,000
Indemnities for the destruction of diseased animals ...	60,000
Stud Farms...	273,371
Encouragement of horse breeding	53,040
Preservation of forests, dunes, watercourses and hill land	190,140

The principal increases are £8,000 for indemnities for the destruction of diseased animals, and £6,000 for stud farms. (*F.O. Report, Annual Series, No.* 4478.)

Damage by the "Nun" Moth in Germany.—About the middle of August, 1909, immense swarms of an insect known as the "Nun" moth (*Ocneria Monacha*) made their appearance in various parts of East and West Prussia. As a result of the ravages of this moth in its caterpillar stage, when it attacks the pine trees, and to prevent the extension of the damage, whole tracts of forests had to be cut down, and it is feared that the process will have to be continued for some considerable time to come. (*F.O. Reports, Annual Series, No.* 4477.)

Drawback on Oats Exported from Germany.—There has of late years been a steadily increasing export of oats to the United Kingdom and other countries, and a good deal of attention is being directed to the operation of the *Zollgutschein* system. Under this system shippers of grain obtain, for every ton which they export, a certificate entitling them to a drawback, or customs credit, to the value of anything that they may subsequently import. That is to say, if they export a ton of goods on which the import duty is 40 marks, they receive a credit note by which they are entitled to import goods to that value. The original intention of the Government was that the *Zollgutschein* should be only applied to the case of imports and exports of the same kind, *e.g.*, that exporting corn would only entitle a shipper to import the

same amount of corn free, but yielding to pressure from the landed interest, the present working of the system is now allowed to be this, viz., that a farmer or landowner may export corn, the customs duty for the importation of which would be £100, and then, when he desires to import coffee, tea, petroleum, or textile goods, which ought to pay £100 in customs duties, he has only to produce his *Zollgutschein* or *Einfuhrschein* and then receive these articles free of duty.

Oats never used to be an article of export, and it is only since the introduction of the *Zollgutschein* system that they have been grown for the sole purpose of being shipped to the United Kingdom and elsewhere. These shipments of oats generally contain a certain proportion of barley, and the Finance Minister has lately ordered that if this proportion exceeds 2 per cent. the *Zollgutschein* shall be given as for barley exclusively, *i.e.*, that the drawback shall be for about a third of what it would be if the oats were pure. (*F.O. Report, Annual Series, No.* 4477.)

Bean Industry of Manchuria.—The British Acting Vice-Consul at Dairen (Mr. G. P. Paton), in his Report for 1909 (*F.O. Reports, Annual Series, No.* 4504), states that it is difficult to make a forecast of the future of the Manchurian bean. Although in South Manchuria the land is already mostly under cultivation, there are still vast tracts in the north untouched by the farmer. The high prices prevailing during the past winter and the undoubted prosperity of the farmer are sure to have led to the opening up of fresh ground in the spring of 1910.

Fruit Trade in France.—The Foreign Office Report on the trade of the district of Lyons in 1909 (*Annual Series, No.* 4483) contains the following notes :—

Fruit growers' co-operation.—Various attempts have been made in the last few years in the direction of the formation of small local co-operative unions of farmers in this district for the disposal of their produce, but hitherto without success. In 1909, however, a group of fruit growers in one commune of the Department of the Rhône, without actually forming a co-operative society, agreed among themselves upon common action for the sale of their cherries on the Paris market, each member of the group being responsible in turn for the collection of the fruit, its delivery to the railway station, and its despatch to Paris. The experiment was a great success, and the growers realised handsome profits, so that it seems likely that the co-operative idea will spread among the agriculturists of this part of France.

Transport of fruit, &c., by rail.—On its side, the Paris, Lyons and Mediterranean Railway Company endeavours to stimulate the cultivation of early fruit and vegetables for the Paris and foreign markets in the districts through which that line passes. By means of special packing arrangements and fast trains, these perishable goods arrive quickly and in good condition at their destination. The special services that are part of this policy have materially reduced the time taken by a package of fruit or vegetables from Lyons to its destination, and the time now occupied in transit from Lyons to Paris and thence to London is only twenty-eight hours.

Potato Production in Germany.—The area under potato cultivation in Germany in 1909 was 8,212,944 acres, and the total yield was

46,706,252 metric tons, or 5·68 tons per acre, of which 5 per cent. were diseased, as against 5·69 tons per acre and 4 per cent. diseased in 1908. There was a large increase in the export of potato products, potato flour and starch amounting to 507,834 cwt. during the first eleven months, against 234,257 cwt. during the same period of 1908. —[*F.O. Reports, Annual Series, No.* 4521.]

Agriculture and Dairying in Denmark.—The Report on the Trade and Commerce of Denmark for 1909 (*Foreign Office Report, Annual Series, No.* 4532) gives particulars of a Bill introduced into the Danish Rigsdag relating to the import and export of agricultural products. The Bill proposed to fix the amount of water allowed in butter in order to meet British requirements, and provided for the inspection of dairies and the prohibition of the use of aniline colouring matter or preservatives other than common salt. It met with some opposition, and was referred to a Committee.

The Report gives a full account of the condition of the agricultural industry during 1909, in the course of which it is observed that the demand for Shorthorns was limited, but a considerable number of Jerseys were bought. A few pedigree sheep were imported from the United Kingdom.

Reference is made to the conference which took place between the British committee of Danish butter importers and the representatives of Danish agriculture on the subject of the Danish official butter quotations.

The number of co-operative societies in 1909 is given as follows:— 1,116 co-operative dairies; 508 State-supported control associations; 35 co-operative slaughterhouses; 1,310 State-supported cattle-breeding associations, with 1,550 animals; 260 State-supported horse-breeding associations, with 310 stallions; and 250 State-supported swine-breeding associations, with 326 boars.

Milking Machinery in Denmark.—Milking by machinery has gained some ground during 1909, and about 150 machines, mostly of the pressure and suction type, are in use. At the same time, it cannot be said that this question has as yet found a satisfactory solution.

Experiments have lately been in progress at a well-known Danish dairy farm under the superintendence of representatives of the Royal Veterinary and Agricultural College of Copenhagen with a view of comparing the relative values of hand milking and milking by machinery. The milking machine under observation was the Lawrence-Kennedy-Gillies patent milking machine.

The experiments were made on cows and heifers, a certain number of each being respectively hand milked and machine milked. In the concluding stages of the experiments, a trial was given to the new milking cup, "Thulekoppen," by means of which all the milk is drawn from the cows, and subsequent milking by hand obviated. For comparative purposes a course of hand and machine milking was conducted extending over three to four months, with the ultimate result that nearly the same amount of milk was obtained by both systems. In the case of full-grown cows a rather larger quantity of milk appears to have been obtained by hand milking, whereas heifers gave a higher yield when milked by the machine. The chemical composition of the milk does not appear to have been affected by the different methods

of milking, nor was there difficulty in the application of the machine. The cows stood quiet when being milked by machine, whereas it was observed that the animals behaved somewhat differently when milked by hand. A machine fitted with two double sets of apparatus performs about the same work as three hand milkers, being able to milk 50 to 60 cows in 2 to 2½ hours.

There are perhaps not yet sufficient data to prove whether in the long run machine milking will give better or less satisfactory results than hand milking or even such good results as are obtained by the latter method, but undoubtedly it will be easier to form an opinion when the cows are more accustomed to being milked by machinery. It is, however, probable that by the help of milking machines, properly used, a more thorough and complete milking will be effected, and that the loss now occasioned by careless milking will be avoided. The difficulty of milking cows when out at pasture has been got over by the introduction of a cart fitted with a benzine motor, air pump, vacuum and piping, easily drawn by a single horse, and on which there is also place for a number of full milk cans.

Examinations of the quality of the milk drawn by the machine point to the fact that the milk is not only purer than the milk from the same cow produced by hand milking, but that it may safely be said that a perfectly pure milk is obtained.

A new milking machine is at present being experimented upon under the control of the State Experimental Laboratory authorities. The advantage claimed for this machine is that it more closely resembles milking by hand, as it works by pressure only, not as is the case usually, by pressure and suction. It is further claimed for this machine that it draws all the milk and produces the same amount as milking by hand.—[*F.O. Reports, Annual Series, No.* 4532.]

Institute for the Investigation of Foot-and-Mouth Disease in Germany.—The report on the trade and commerce of Pomerania for the year 1909 (*Foreign Office Report, Annual Series, No.* 4517) states that an institute is to be established on the small Baltic island of Riems, near Greifswald, for the purpose of carrying on bacteriological research with a view to stamping out foot-and-mouth disease. The Board of Agriculture has granted the necessary funds, and the institute will be placed under the control of the University of Greifswald.

This small island has been chosen on account of its isolation, as several outbreaks of foot-and-mouth disease in the neighbourhood of Greifswald were attributed to the transmission of germs when the researches were carried out at this latter place.

Production of Nitrate of Soda.—The Chilian Nitrate Combination, which formerly regulated the production of nitrate of soda, was dissolved in 1909. Mr. Consul Hudson, in his report on the trade of the district of Iquique, Chile (*F.O. Reports, Annual Series, No.* 4510), states that in the first year of free production (April 1st, 1909, to March 31st, 1910) there has been an increase in the total output of 7,732,325 quintals of 110 lb., as compared with the output during the last year of the Combination (April 1st, 1908, to March 31st, 1909), whilst the world's consumption in the year 1909 (January 1st to December 31st) shows an increase of 4,559,769 quintals over that of the previous year. The average price of nitrate for 95 per cent. f.o.b. was 8*s.* 7½*d.* per

quintal in 1907; in 1908 it was 7*s.* 6½*d.*, while in 1909 it fell to 6*s.* 10⅝*d.* per quintal.

The possibility of an immediate renewal of the Combination appears to be doubtful, although there is an indication that those who were opposed to it and were the cause of its non-renewal are now more favourably disposed to something being done in this direction. If this should be brought about prices would no doubt rise.

Co-operative Associations in Russia.—Information is given in a report on the trade of Russia during 1909 (*Foreign Office Report, Annual Series, No.* 4533) with regard to the spread of co-operative associations connected with agriculture in the consular district of Moscow. Societies have been formed in connection with bee-keeping, the sale of fruit, wine-making, the purchase of goods at fairs and from factories, egg-farming, cattle-fattening, &c. Other associations have advanced loans on, or acted as intermediaries in the sale of grain, and the operations of the associations giving advances on grain have been largely extended by means of loans obtained from the State Bank.

Notes on the Weather in August.

At the beginning of the *first* week the weather over England was mostly fair and dry, but in Scotland the conditions were less settled, and on Tuesday rain extended to all parts, the rest of the week being cool and very changeable. Temperature was below the average in most of the western and southern districts, and in the Midland counties; elsewhere it agreed closely with the normal. Rainfall varied; in England S.E. and S.W. it was classed as "heavy," and there was a smaller excess over the average in Scotland E., but in other districts there was a fairly general deficit. Sunshine was "abundant" in England E., "moderate" over the rest of England, and "scanty" in Scotland.

The weather was fair and dry about the middle of the *second* week, but at other times it was in a changeable, showery condition over the country generally. Temperature was above the normal, especially in the north and west of England and in Scotland, but the duration of sunshine was small except in Scotland N. and E. Rainfall was generally slight.

During the *third* week the general conditions were again unsettled. Rainfall was "heavy" in Scotland and in England except in the east, where it was "moderate," and the south-east "light." Warmth was classed as "unusual" everywhere, but sunshine was "scanty" in Scotland W., and "moderate" elsewhere, except in England S.W. (abundant).

In the *fourth* week unseasonable and unsettled conditions still prevailed over the whole country. Rainfall exceeded the normal, except in England S.E., the excess being as a rule large, especially in the north and north-west. Temperature was below the normal except in England E., and sunshine was also low, this latter being "moderate" only in England E., and "scanty" or "very scanty" everywhere else.

The records for the thirteen weeks of summer, from June 5th to September 3rd, show that rainfall has been above the average, and sunshine and warmth have been below the average almost throughout the country, the only exceptions being that temperature was higher than the normal in Scotland N. and W., and rainfall was below the average in Scotland N.

Report on Crop Prospects on September 1st.

The Crop Estimators of the Board, in reporting on the state of the crops and the agricultural conditions on September 1st, generally refer to the adverse effect of the weather during August upon the cereal crops, and the average prospects of all three are now somewhat lower than a month ago; both wheat and oats being now reported as below average, and barley an average. Harvesting became general, in the south, by about the middle of August, and a week or so later in the north of England; but owing to the wet and stormy weather towards the end of the month, comparatively little progress had been made, except in some early districts. Prospects for all three corn crops remain less satisfactory in the east and south than in the north, although the storms at the end of the month appear to have been quite as severe in Scotland as in England.

Beans are practically unchanged, but peas have deteriorated during the month.

Potatoes have been attacked by disease, especially in the south and east, the northern districts apparently being less seriously affected. As a result, a considerable falling off is to be noted in their average condition, although prospects still indicate a yield above normal, especially in Scotland.

Roots have improved during the month, particularly turnips and swedes, which now appear likely to be the best crop of the year. The improvement in mangolds is less marked, want of sunshine being particularly regarded as the cause.

Hops are reported to have improved during the month; there are fewer reports of vermin than usual, though mould has been troublesome in some places. Picking began at the end of August in Kent, and was expected to be general during the first week of September.

All tree-fruit is scarce, although plums are not so scarce in Worcestershire as was previously reported.

Pastures generally are full of grass, but not always of good quality, in consequence of excess of moisture and lack of sunshine. Cattle and sheep are reported to be doing well on the whole, but excessive wet and low temperature have been rather against them in many parts of the country; husk is reported from a few districts, and foot-rot is prevalent in certain localities.

The supply of labour is sufficient to meet all requirements at present. More temporary labour than usual will be required for the corn harvest, particularly in Scotland, where there may possibly be a scarcity in some districts.

Summarising the reports, and representing an average crop by 100, the appearance of the crops on September 1st indicates yields for Great Britain which may be represented by the following percentages:— Wheat, 99; barley, 100; oats, 98; beans, 102; peas, 99; potatoes, 103; turnips and swedes, 106; mangolds, 103; hops, 103.

Summaries of the condition of the different crops in each district are included in the report. The state of the hop crop is given as follows:—

Hop Crop.—In *Kent* there has been general improvement since August 1st, but much now depends upon the weather. Little vermin is now reported, but mould has been very troublesome in some gardens. Picking began at the end of August, and with favourable weather will

now be general. In *Surrey* excessive wet and stormy weather is said to have hindered development, and the yield is uncertain. Some mould is reported. In *Sussex* hops are reported to be looking well. In *Hampshire* hops are fairly promising, but suffered a good deal from recent storms. In *Worcester* hops are generally healthy and well fruited, but small; a good deal of washing has been necessary in some yards. Picking was expected to be general early this month. In *Hereford* there is little change since August 1st, though the crop has been somewhat checked by cold rains, and the bine has been blown about and bruised. Very little washing was necessary during August. With favourable weather, picking was expected to commence early this month.

Notes on Crop Prospects Abroad.

The following information has been published by the International Institute of Agriculture, Rome, in the Bulletin of Agricultural Statistics for August (No. 8), and shows the average condition of the crops on or about August 1st.

(100=AVERAGE CONDITION.)

Country.	Wheat. Winter.	Wheat. Spring.	Barley.	Oats.	Maize.
Austria * [1]	2·5	—	2·7	2·9	2·1
Canada [2]	84·6	77	—	79·5	—
Denmark...	100	—	98	97	97
Germany * [1]	2·3	2·6	2·6	2·7	—
Great Britain	101	—	102	99	—
Hungary	115	—	100	93	119
Japan	115	100	—	—	100
Roumania	—	—	—	—	150
Sweden	109	—	108	108	—
Switzerland	—	—	—	90	97
Tunis	—	—	—	—	100
United States	—	74·5	82·1	98·7	96·6

* 15th July. [1] Scale: 1=very good; 2=good; 3=average; 4=poor; 5=very poor. [2] Percentages of a standard condition.

APPROXIMATE ESTIMATE OF YIELD OF CEREALS.

Country.	Wheat.	Rye.	Barley.	Oats.
	cwt.	cwt.	cwt.	cwt.
Bulgaria	34,921,000	—	4,526,000	—
Canada	10,036,000	—	—	—
Denmark	2,189,000	9,302,000	3,343,000	12,972,000
Hungary	101,305,000	28,657,000	27,535,000	22,946,000
Italy	99,058,000	2,696,000	4,595,000	10,298,000
Japan	11,809,000	—	35,933,000	680,000
Roumania	57,781,000	4,109,000	12,811,000	8,149,000
Spain	73,270,000	15,902,000	35,963,000	8,778,000
Switzerland	1,830,000	984,000	197,000	1,476,000
Tunis	2,952,000	—	2,853,000	1,535,000
United States	245,445,000	16,039,000	—	—

The following supplementary notes are given :—

Canada.—An exceedingly high temperature in the Prairie Provinces has been injurious to the crops. The rainfall during the month, in the southern half of the country, has been less than an inch; in the northern half, however, light rains have proved extremely beneficial to the crops. Sufficient rain has fallen in the Eastern Provinces, and the crops are excellent.

Denmark.—Wheat heads are well filled. Rye is not thick, but the quality is good. Oats ripened very quickly.

Germany (*Landwirtschaftsrat, August* 15*th*).—The rainy season, which ended with the latter weeks of July, though in many respects beneficial, has also caused great damage to the crops. The harvest estimates made on August 1st fell somewhat short of expectations. All cereals have ripened exceptionally early this year. The rye harvest, which was delayed by bad weather, is not yet finished. Reports as to quality are contradictory. Spring crops, which have suffered through lodging, will scarcely yield an average harvest. Oats have recovered from the drought, but barley has depreciated. The following figures represent the estimated yield in percentages of a normal harvest :—Winter wheat, 94·0; spring wheat, 88·4; winter rye, 94·3; spring rye, 83·8; barley, 89·4; oats, 89·5.

Hungary.—On August 1st, 98 per cent. of the area of wheat and of rye, 90 per cent. of the area of barley, and 85 per cent. of that of oats were already harvested. Trial threshings were made immediately after the harvest. The high condition of the crops had given rise to hopes which have not been completely realised in the ultimate yields. In the plains, where an exceptionally large harvest had been expected, an average has scarcely been reached in several districts. These conditions are explained by the completely abnormal weather conditions. Storms and rains caused considerable damage to the crops immediately before the harvest, and both quality and quantity have suffered in consequence. On the whole, the damage is not excessive. The results of late years have been far inferior to the present crop. Winter crops are giving good results, and spring crops an average. Maize promises well.

Italy.—The first days of July were cool and rainy, but during the latter part of the month warm and dry weather prevailed. The results of the drought are now being felt, especially in southern Italy. Some threshing results show that the wheat harvest will fall a little short of estimates made at the end of June. This difference is principally due to the fact that a few days previous to the harvest, the ripening of the wheat was unduly hastened by the heat of the sirocco, and the grain deteriorated in consequence. Maize is good in northern Italy; but in central, and more especially in southern Italy, this crop has suffered from the drought.

Luxemburg.—The continued rains of the past weeks have lodged many of the cereal crops. Complaints are made of damage by field mice and other vermin. Only oats and barley seem to have profited from the rain. In spite of evident damage from the unfavourable conditions, the general aspect is very good.

Russia.—Weather conditions during June and during the first ten days of July (old style) showed some improvement. Although the crops

have suffered from heat and drought (principally in the south, and along the course of the Volga) the general condition for the whole Empire has considerably improved. The condition of winter crops has improved in the central provinces and east of Moscow, as a result of the rains during the latter part of June (old style). Russia in Europe will probably give an average out-turn, though the aspect of the wheat and rye crops varies considerably in different districts, according to the time of sowing, the conditions then prevailing and the quantity of rain that has since fallen. A good or over-average out-turn is expected in the Black Soil Belt, east of the Dnieper.

The condition of the spring crops has been considerably improved almost throughout the Empire by the rains which fell during the second half of June (old style). The crops have depreciated only in the extreme south-west of Russia. In the large extent of country in West Russia—in the upper and central basin of the Dnieper—there is no apparent improvement in the conditions of spring crops, the June rains having arrived too late. However, about an average harvest for spring crops may be expected.

Sweden.—Rye has suffered from frost in different parts of the country.

Switzerland.—Incessant rains have considerably retarded the development of the cereals, and have caused lodging. The grain is small, and the yield will not be abundant.

Tunis.—Harvesting is completed everywhere, and threshing is progressing well. In the north (Valley of Medjerdah, Beja, Mateur, and around Tunis) the yield is satisfactory on the farms of the European colonists who sowed early and in well prepared soil; but on the native farms, where sowing was done late and in badly worked ground, the yield is remarkably inferior. In the centre and south, the yields of cereal crops are only mediocre this year.

World's Grain Crops.—The Hungarian Minister of Agriculture issued his preliminary estimate of the world's grain crops on August 31st, based as regards Hungary and Austria on the official Government report, and as regards foreign countries on Austro-Hungarian consular reports. The estimates for last year are also revised. The totals for the various crops are as follows :—

	1910. Thousands of qrs.	1909. Thousands of qrs.
Wheat	456,020	445,770
Rye	214,910	220,060
Barley	195,390	204,420
Oats	458,640	502,000
Maize	492,450	446,990

The wheat crop is thus put at 11,000,000 qrs. more than in 1909. The deficit of wheat in the importing countries is estimated to be 71,000,000 qrs., while the surplus available for export in the exporting countries is estimated at 88,000,000 qrs. (See also *World's Wheat Crop* below.)

World's Wheat Crop.—According to estimates made by two of the leading corn trade papers, the wheat crop of the world for 1910 is likely to be below that of last year, but above that of 1908. An estimate

issued by the Argentine Ministry of Agriculture, and based upon the reports of their Consular officials, agrees substantially with these figures as regards the present year.

The following table shows the total production as given in *Beerbohm's Corn Trade List* (August 12th) and in *Dornbusch's Evening List* (August 19th), and as estimated by the Argentine Ministry of Agriculture. The figures for previous years are added for comparison.

	Beerbohm. Qrs. (480 lb.).	Dornbusch. Qrs. (measured).	Argentine Ministry of Agriculture. Qrs. (480 lb.).
1910 ...	436,500,000	432,768,000	430,240,000
1909 ...	455,520,000	452,356,000	397,650,000
1908 ...	399,065,000	398,145,000	—

World's Hop Crop.—Messrs. John Barth and Son, of Nuremberg, in their first report on the hop crop, dated August 22nd, state that the plants have hitherto successfully resisted the unfavourable temperature, and though the state of the plantations is in nearly all districts unequal, the good plantations are considerably in the majority.

In Bavaria the condition is best in the Spalt district, but the outlook is also good in the Hallertau. The country and mountainous districts of Bavaria promise a normal yield, and this is also the case in Wurtemberg, Baden, Alsace-Lorraine, and Prussia. The reports from Saaz, in Bohemia, are especially promising. The yield in this district is expected to be double as much as in 1909, while the other districts of Austria-Hungary will also produce more than in 1909. In France and Belgium a considerably higher yield than last year is expected, but Russia will hardly reach last year's level.

Messrs. Barth anticipate a proportionately small crop in England, but the production in the United States is likely to exceed that of last year.

Although the crop is largely dependent upon the weather, at the end of August and the beginning of September it is approximately estimated at a normal one of about 1,500,000 cwt. to 1,700,000 cwt. The English yield is put at 300,000 to 340,000 cwt., and that of the United States at 400,000 to 450,000 cwt.

The consumption of hops amounts to about 1,660,000 cwt., and the stocks in the hands of Continental brewers are stated to be much reduced.

Canada.—The Bulletin issued by the Canadian Census and Statistics Office, dated August 12th, states that in the Eastern Provinces the growth of field crops has been uniformly good throughout July, but in extensive tracts of the North-West drought has prevailed. The average condition of spring wheat for the whole of Canada is 77, compared with 84·57 in 1909, while in the three North-West Provinces where it is principally grown the condition is 62. Winter wheat is put at 84·63 compared with 76·53 in 1909, and the estimated yield at 18,724,000 bushels, or 26·47 bushels per acre. The average condition of oats is 79·57, compared with 87·78 last year.

Germany.—The condition of crops in the middle of August was reported by the Imperial Statistical Bureau to be as follows:—Winter wheat, 2·5; spring wheat, 2·7; winter rye, 2·6; spring rye, 2·7; barley, 2·7; oats, 2·7; potatoes, 2·8 (1 = very good; 2 = good; 3 = medium

(average); 4 = small). Very unfavourable weather had been experienced in all parts of the country, with the exception of the province of Posen, during the month preceding the date of the report, and rain had seriously interfered with harvesting operations. Complaints of damage by mice were common, and Prussia suffered most from insect pests. The yield of winter cereals was expected to be well above average in Bavaria, but in other places the prospects were not so good. With regard to spring cereals, barley had already been harvested, but had suffered from the weather where delay had taken place in getting the crop under cover; in south Germany the condition of oats was more satisfactory than that of barley. The damage done by rain was greatest in the case of potatoes, and disease appeared in many districts. On light soils the tubers were well developed, but elsewhere were reported to be small.

Hungary.—Full advantage was taken of a period of finer weather, and the harvest was over in most parts of the country, with the exception of some of the mountainous districts by the middle of August. The yield is only normal in many parts where the hope of an abundant harvest was entertained, the crops having suffered both in quality and quantity by the unfavourable weather experienced before harvest. The estimate of the Hungarian Minister of Agriculture, issued in August, places the yield of all cereals below that estimated in June, and is as follows:—Wheat, 101,305,000 cwt.; rye, 28,657,000 cwt.; barley, 27,535,000 cwt.; oats, 22,946,000 cwt.

A report of the Ministry of Agriculture, dated 27th August, states that in general a good crop of maize is expected, and the yield is estimated at 93,840,000 cwt. as against 80,907,000 cwt. in 1909. The prospects for potatoes are not so favourable owing to the hot, dry weather experienced during the latter part of August and disease is general. The yield is estimated at 47,543,000 tons, below the yield of 49,144,000 tons in 1909.

United States.—The Crop Reporting Board of the United States Department of Agriculture, in its report on the crops on September 1st, states that the average condition of spring wheat at harvest was 63·1, compared with 88·6 on September 1st, 1909, and a six-year average of 80·0. The condition of the oats crop at harvest was 83·3, compared with 83·8 last year, and 79·5, the mean of the averages for ten previous years. Barley is put at 69·8, against 80·5 last year, and a ten-year average of 83·3; and maize is 78·2, against 74·6 in 1909, and a ten-year average of 79·5. (*Dornbusch,* September 8th.)

Roumania.—Mr. Errol MacDonell, British Consul at Bucharest, writing on September 1st, states that according to the statistics of the Ministry of Agriculture the wheat harvest has not been so abundant as was expected. The crop is, however, estimated at 103 million bushels. This exceeds last year's crop by over 45 million bushels, but does not equal that of 1906, which amounted to 110 millions. The internal consumption is estimated to be 27½ million bushels, and therefore the surplus available for exportation amounts to nearly 76 million bushels. The total crop of barley is estimated to be nearly 29 million bushels, which is in excess of last year's crop, and that of oats 27½ million bushels.

Agricultural Labour in England during August.

The Board of Agriculture and Fisheries have been furnished by the Board of Trade with the following report, based on returns from correspondents in various districts, on the demand for agricultural labour in August:—

Employment was generally regular, but day labourers and men on piecework lost a good deal of time in some parts of the country on account of wet weather, which often considerably hindered work towards the end of the month. Harvesting and hoeing caused a fair demand for extra men, but the supply was sufficient and frequently tended towards an excess. Several correspondents referred to a smaller demand for harvesters than last year.

Northern Counties.—Nearly all reports from these counties mention an interruption to work from wet weather, and day labourers were consequently somewhat irregularly employed. There was generally an ample supply of such men, but in the Morpeth Union (*Northumberland*) some scarcity was reported. A correspondent in the Patrington Union (*Yorkshire*) states that there were more Irish labourers seeking work than for some years past.

Midland Counties.—Extra men employed on the corn harvest lost some time through rain in most districts. The supply of such men was generally ample, and a surplus was reported in certain districts. There was generally a sufficient supply of men for permanent situations, but a demand for carters was mentioned in the Pershore (*Worcestershire*) Union.

Eastern Counties.—There was a fair demand for extra labourers in these counties on account of the corn harvest, hoeing, hedge-trimming, &c., and generally not much loss of time was reported. With the exception of certain districts in *Suffolk*, where there was some scarcity of men for hoeing, the supply of extra men was sufficient, and in several districts, more particularly in *Essex*, a surplus was reported.

Southern and South-Western Counties.—Day labourers employed at haymaking and harvesting lost some time through rain in most districts. The supply of such men was generally equal to the demand, and was reported to be more than sufficient in some districts in *Kent, Sussex, Hampshire,* and *Dorset.* Some scarcity of men for permanent situations was reported from the Godstone (*Surrey*) Union, the Petworth (*Sussex*) Union, and the Axbridge (*Somerset*) Union, and from several districts in *Herefordshire, Gloucestershire,* and *Cornwall.*

Prices of Hops in 1909.

The Report on the Agricultural Statistics (Part III.) recently published contains the following observations on the prices of hops in 1909:—Unfavourable weather in September delayed picking, and very little trade was done in new hops in London until the last week of the month, when the chief feature of the trade was the heavy purchases by German buyers of green hops at prices ranging from 110*s.* to 130*s.* per cwt. A limited but firm trade in yearling and old hops was reported during the month. The shortage

of the new crops encouraged growers to hold their stocks, while reports from America and the Continent of small yields also strengthened the market. October opened with an active trade, German buyers still operating. Values advanced, and the following prices per cwt. were obtained:—East and Mid Kents, 120*s*. to 180*s*.; Weald of Kents, 120*s*. to 168*s*.; Sussex, 110*s*. to 150*s*.; Farnhams, 130*s*. to 175*s*.; Worcesters, 140*s*. to 180*s*. The top prices quoted are two or three times as high as at the same period of 1908, and the minimum prices are four or five times as high. The very great variation as between the two seasons illustrates the price fluctuations to which the hop industry is subject. During October, 1909, the general demand was maintained and prices were firmer. By the 27th of that month it was estimated that fully two-thirds of the new crop was in the hands of the merchants, and the practical clearance of choice lots raised the value of medium qualities. In November the demand for new hops was steadily maintained and prices advanced slightly. Continental hops were quoted at much higher rates than best English, and Pacifics were selling at 160*s*. per cwt. and upwards. Yearling and old hops gradually advanced in value. In December trade was quiet, but prices were no lower, the remaining stocks being firmly held. The last weekly report of the year received from the Board's market reporter stated:—"The present position of the Borough Hop Market is practically unprecedented. It may be safely stated that never in the history of the trade has the supply of English hops on offer at this period been so small. The factors' boards are almost bare, and, with few exceptions, the stocks held by merchants are limited, yet there is no demand, and therefore prices remain nominally at the same level as they have been during the past five or six weeks. . . ."

THE CORN MARKETS IN AUGUST.

C. KAINS-JACKSON.

Owing to the lateness of harvest, practically no new English wheat was on sale during August, and the markets having to rely exclusively on old and seasoned wheat were somewhat in sellers' favour for bread-stuffs. The time of year being adverse to a brisk demand for feeding-stuffs, those staples were at best maintained in price. In many respects, the chief event of August at Mark Lane was the advance in linseed prices to a level constituting a trade record, nor did the last fortnight of the month show any abatement of a stringency which made itself felt by the 15th. Linseed being the basis of the oilcake most prized for fattening livestock, the situation has a very serious side for interests even more extensive than those ordinarily under notice at Mark Lane.

Wheat.—The sales of old English wheat were much above the average, and the crop, of which deliveries in the first half of the cereal year were small, has in the latter part of the season been offered more freely than usual. In market phrase, "it has lasted out uncommonly well." Millers probably hold more than usual at the end of a cam-

paign, for they are doing a very fair business with bakers in contracts to deliver during the next four or five weeks flour mixtures guaranteed half-old, half-new crop wheat. The August rainfall was not extraordinary, but the cloudy and rain-laden atmosphere did not conduce to either quality or condition in the new harvest, which is accordingly felt to require an unusual amount of "stiffening" with drier and more seasoned corn. The selling value of new wheat at the last few markets of August was 1*s*. to 2*s*. more than that of 1909 grain. Imported wheat has been extremely firm for spring sorts, and the average price has been 41*s*. to 41*s*. 6*d*. for Minnesota and Wisconsin, and 41*s*. 6*d*. to 42*s*. 6*d*. for Dominion wheat. The advance of the latter to 43*s*. 6*d*. and 44*s*. at the end of July, was an emergency rise, but the market soon "found itself," and for the last three weeks of August was steady at the prices given. Owing to large new crop arrivals, Indian wheat has declined 6*d*. to 1*s*. per qr., but a good trade has been induced by this concession, which makes Indian produce the best current bargain in imported wheat. Russian ranged from 37*s*. to 40*s*. per qr., and by reason of very careful selection being required was not in general favour. The Shipping Lists, which at this time of year publish crop estimates which are very closely studied by the exchanges, show this season a remarkable agreement in putting the world-production of wheat at from 19 to 19½ million qrs. less than last year. They agree in estimating the home crop at seven million qrs.

Shipments for August were 333,000 qrs. from North America, 649,000 qrs. from South America, 1,439,000 qrs. from Russia, 1,055,000 qrs. from Europe S.E., 700,000 qrs. from India, and 201,000 qrs. from Australasia. The Indian and Argentine contributions exceeded an August expectation, while Russia surpassed any total previously known in her August trade. North America's extremely small exports prevented aggregate shipments from being overwhelming, but the grand total was still considerable. Continental buying coming to the relief of British markets, the supply on passage fell during the month from 2,550,000 to 2,350,000 qrs. It is to this feature of a sharpened competition with Continental purchasers that the operators at the "Baltic" are more particularly looking at the present moment.

Flour.—London makes of flour have receded 1*s*. per sack on the month, the 3*s*. advance from Midsummer to Lammas proving too great a check on buying. At 34*s*. Top-Price, and 28*s*. 6*d*. Town Household, business has been very fair for the time of year. Country flour has been slow, but before the month closed was in better request at about 25*s*. for Roller Whites. There has been a disposition to accept rather less money for imported flour, as the advance of July reduced business to a very serious extent. America shipped only 178,000 sacks in August, the smallest monthly total for a very long period. On the last day of the month the 91,000 sacks on passage constituted almost, if not quite, a minimum record within living memory. There are, however, some heavy contracts for Hungarian to be shipped in the three last months of the cereal year.

Barley.—So far as English barley is concerned, the trade has been at full ebb, and the agricultural press has been protesting against the microscopical sales on which averages were struck. Such averages, of course, are required by Statute, and change, if politic, can only come

through the Legislature. A fair business has been done in Russian feeding barley at about five shillings per cental. When prices fall to this level, the bedrock of value appears to be reached, as inquiry promptly freshens. August shipments were 1,360,000 qrs. from Russia, 100,000 qrs. from Europe S.E., and 55,000 qrs. from Pacific ports. There were on the 31st, 295,000 qrs. on passage as compared with 200,000 qrs. at the end of July.

Oats.—New winter oats appear to be of fair to good quality, though not quite fit for immediate feeding use. They were secured, for the most part, during the fine weather spell early in the month. Prices vary from 18*s.* to 20*s.* per qr., the higher quotation securing 336 lb. weight. The main or spring crop was not on sale in any appreciable quantity during August. Imported oats were dull at 14*s.* per 304 lb. or thereabouts for large purchases at the ports, and at five shillings per cental on most inland markets. The August shipments were 1,057,000 qrs. from Russia and 110,000 qrs. from La Plata. All other shippers failed to put together 50,000 qrs. between them. The quantity on passage on the last day of the month was 410,000 qrs.

Maize.—The great increase in the supply on passage, from 900,000 to 1,370,000 qrs., indicates the prospect of autumn deliveries to be much above the average with respect to quantity. As over a million quarters are yellow corn, a plethora of one type and a scarcity of the others is probable, but, fortunately, the differences in maize are slight, and the yellow sort will serve most feeding purposes. Shipments during August were 39,000 qrs. from North America, 1,878,000 qrs. from South America (Yellow Maize), 86,000 qrs. from Russia, 215,000 qrs. from Europe S.E., and 15,000 qrs. from South Africa. Spot value at the end of August averaged about 25*s.* for the chief sorts, but Argentine for future delivery was quoted at 23*s.*, and cargoes for October shipment were offered at 22*s.* 6*d.* per qr.

Oilseeds.—After a month of very stringent markets linseed closed at 74*s.* per 416 lb. for best Bombay, 72*s.* per 410 lb. for good Calcutta, 68*s.* per 416 lb. for good La Plata, and at about that figure for English, Russian, and Canadian if procurable. Rapeseed, sesame, poppyseed, sunflowerseed, and cottonseed have all hardened in price in sympathy with the leading oilseed. The new English rapeseed is of good quality and is held for 60*s.* per 416 lb. On the last day of the month 150,000 qrs. of linseed, 19,000 qrs. of rapeseed, and 31,750 tons of cottonseed were on passage. Linseed shipments for August were 267,000 qrs. from India, and 149,000 qrs. from South America. Oilcake and seed oils follow the rising market for "raw material."

Various.—New beans and peas are coming on sale at 31*s.* and upwards. They are less depreciated by the unfavourable harvesting than had been feared. Some very fine seed rye has fetched 28*s.* to 29*s.* per 492 lb., while ordinary new feeding rye is on offer at 23*s.* to 24*s.* per 472 lb. There is a remarkable scarcity of new trifolium seed, which, being in immediate requisition, rose before August closed to the remarkable price of 55*s.* per cwt. Fortunately for sowers, one-fifth of a cwt. will suffice for an acre.

THE LIVE AND DEAD MEAT TRADE IN AUGUST.

A. T. MATTHEWS.

Fat Cattle.—The markets generally have continued to be well supplied with fat cattle, though, as the season advances, there is the usual falling off in the proportion of those that can be described as of finest quality. This was more particularly the case at Islington, where, on the second Monday in the month, there were really no first-class Shorthorns offered. Herefords have come out well, both at that market and other markets where they are usually present. Their average prices have therefore been relatively high, but towards the close of the month there was a falling off in their condition and average price, while the Devons, which did moderately at first, in the fourth week surpassed the average of the Herefords. Welsh Runts have, so far, been sparingly offered, but their season comes nearer the close of the grazing time.

The average price of Shorthorns in about twenty English markets was 8*s.* 10½*d.* per stone, which was a decline of 2*d.* per stone on the July average. Second quality averaged 7*s.* 11½*d.*, also a decline of 2*d.*, and cows and bulls 6*s.* 11¼*d.*, a decline of 1¾*d.* per stone. Herefords averaged 9*s.* 1*d.* and 8*s.* 4*d.* for first and second quality respectively, against 9*s.* 5*d.* and 8*s.* 7*d.* per stone in July. Devons averaged 9*s.* 1*d.* and 8*s.* per stone against 9*s.* 2*d.* and 8*s.* 0½*d.* in July. Prices generally declined very gradually, but at the end of the month there appeared to be a firmer tendency. Such a decline as there was may be more than accounted for by the falling off in the condition of the animals, and the consequent loss to the butcher on the value of the offal.

Veal Calves.—The calf trade was fairly good, and with fewer calves on offer as the month advanced, prices stood at 9*d.* per lb. at a few markets. The average value for the month, however, in twenty-six markets of Great Britain, remained exactly the same as in July, viz., 8¼*d.* and 7¼*d.* for first and second quality respectively.

Fat Sheep.—The trade in fat sheep appears to have settled down to a singular steadiness in values which are very moderate in character. They are, in fact, just about half-way between those ruling before the collapse which took place about 2½ years ago, and those which followed for many months while the depression existed. Second quality sheep are now realising as much as the very best were worth during a large portion of 1909, while really choice sheep are fetching fully 1*d.* per lb. more. Prime quality so long made 9*d.* per lb. that 8*d.* seems a low price, while it is in reality a medium one. The averages for the month of August are very similar to those of July.

In seventeen of the most important English markets prime small Downs fetched a fraction over 8*d.* per lb., against 8¼*d.* in the previous month. Second quality (of which the larger portion of the supply is now composed) realised 7*d.*, and fat ewes 5¾*d.* per lb. Prime Longwools made 7½*d.*, the same as in July, while second quality averaged 6¾*d.* (an advance of ¼*d.*), and third quality 5¼*d.* per lb.

Fat Lambs.—Although the season for lamb is rapidly drawing to

a close, large supplies continue to come forward, and a peculiar interest, which does not, perhaps, quite appear on the surface, attaches to the trade. Prices per lb. have slightly declined when compared with those of July, the averages being $8\frac{3}{4}d.$ and $8d.$ per lb. for first and second quality against $9\frac{1}{4}d.$ and $8\frac{1}{4}d.$, but it must be remembered that another month's growth has added considerably to the average weight of the animals. The fact is that there has been a better demand for the bigger lambs, although the price per lb. has been somewhat lower. They are now being largely taken by butchers to sell as small mutton in order to satisfy the demand of their customers for small joints.

Fat Pigs.—The advance in the value of fat pigs, which took place at the end of July, was well maintained through August, and the average price of bacon pigs in about thirty British markets was $8s.\ 2\frac{1}{4}d.$ per 14 lb. stone for first, and $7s.\ 7\frac{1}{4}d.$ for second quality.

Carcass Beef—British.—Supplies of British beef to the London Central Market were on a very moderate scale, and prices were remarkably steady. The quality of the English on offer left much to be desired, and quotations were low in relation to other classes of beef. With slight variations from week to week, the general averages for the month were slightly lower than for July. Scotch long sides averaged $7\frac{1}{4}d.$ and $7d.$, and English $6\frac{5}{8}d.$ and $6\frac{1}{8}d.$ per lb. for first and second quality.

Port-killed Beef.—Town-killed beef appears to be a steadily diminishing quantity. Much of that received in August was of poor quality, and, consequently, the London average was slightly lower on the month. First quality realised $6\frac{5}{8}d.$, and second $6\frac{1}{8}d.$ per lb.

Chilled Beef.—Argentine chilled was well supplied, but American was again very short. Best Argentine hindquarters averaged $5\frac{1}{8}d.$, and best forequarters $3\frac{3}{4}d.$, while that that from the United States made $6\frac{3}{4}d.$ and $4\frac{3}{4}d.$ per lb. respectively.

Frozen Beef.—Frozen beef continued plentiful, and averaged $3\frac{1}{2}d.$ per lb. for best hindquarters, and $2\frac{7}{8}d.$ for fores.

Carcass Mutton—Fresh Killed.—Scotch mutton was again in moderate supply, and sold slowly in London at about $7\frac{1}{2}d.$ per lb., while West Country English made from $6d.$ to $6\frac{1}{2}d.$ Dutch averaged about $6\frac{1}{2}d.$ per lb. for best quality.

Frozen Mutton.—Supplies appeared to be unlimited, and prices ranged from $3\frac{3}{4}d.$ for prime New Zealand down to less than $3d.$ for large quantities of Australian.

Carcass Lamb.—The demand for British lamb was very limited, and the best Scotch scarcely exceeded $7\frac{1}{2}d.$ per lb. Prime New Zealand remained steady at $5\frac{1}{4}d.$, and a good deal of Dutch fetched as much as the British.

Veal.—Veal became scarcer after the first week, and some prime Dutch made fancy prices. The averages at Smithfield for first quality were $8d.$ per lb. for Dutch and $7\frac{3}{4}d.$ for English. Large quantities of Dutch were sold at $6d.$ per lb.

Pork.—The trade was extremely limited in character, but prices were slightly higher than in July. The price of English was $6\frac{1}{2}d.$ to $7\frac{1}{4}d.$, and of Dutch $6\frac{1}{4}d.$ to $7d.$ per lb.

THE PROVISION TRADE IN AUGUST.

HEDLEY STEVENS.

Bacon.—The month of August has experienced a general reaction in nearly all descriptions of hog products, doubtless influenced by the unseasonable weather, and it is generally thought that the highest point has been passed, though it may be some months before any appreciable reduction is experienced.

During the month singed sides have fallen as follows:—Irish, about 2*s.*; Continental, 5*s.* to 7*s.*; and Canadian, 6*s.* to 8*s.* per cwt. Most descriptions of American bacon and hams show reductions of from 3*s.* to 5*s.* per cwt., with the one exception of clear bellies, which are dearer on the month on account of extreme scarcity.

Russia is sending more bacon to Great Britain, and it is reported that more English capital is being invested in the pig-curing business in that country, as it is likely to prove remunerative. There is a prospect of continued small supplies from the United States and Canada. Holland is also pushing for a larger share of our bacon trade.

Small consignments of cured bacon continue to be received from Australia. This bacon has turned out in good condition, and the prices realised have been near those current for Continental descriptions. These shipments have been experimental, and will doubtless increase.

Arrivals from the United States and Canada have been a little in excess of those in July, and as the consumption is reported to have fallen off in the States, it is thought that the shipments from that country will show slight increases from now onwards. Early in the month their prices for hogs ranged from \$7.45 to \$8.95, according to the selection, but by the end of the month they had advanced to \$8.45 to \$9.50. In the month of August last year prices ranged from \$7.35 to \$8.20, and two years ago \$6.05 to \$6.90.

English and Irish pigs are slightly cheaper on the month, but curers still complain of the shortage of supplies of suitable weights for their requirements.

Cheese.—Dealers again complain of a small consumptive demand for Canadian cheese, though prices have been reasonable, and 2*s.* to 4*s.* per cwt. below those current in August last year. This has doubtless been partly brought about by the large make of cheese in our own country, and consequent low prices, the increased make being the result of the weather conditions continuing in favour of a large flow of milk, a smaller proportion of which has been required for drinking purposes this summer, on account of the cool, damp weather.

Prices in Canada have not shown much change. At the end of the month the best August makes could be contracted at 53*s.* 6*d.* c.i.f., and unless the demand in this country shows some real improvement early in September, it is thought that the September makes will be bought at about the same figure. To the middle of August the shipments from Canada this season were about 47,000 boxes less than for the same period last year.

At the end of the month the estimated stock of Canadian cheese at the three principal distributing centres (London, Liverpool, and Bristol)

were 340,000 boxes, against 295,000 last year, and 265,000 two years ago. Stocks of last season's makes of Canadian and New Zealand are now in very small compass.

It is reported that some contracts have been made for the coming season's output of several factories in New Zealand at about 55*s.* 6*d.* c.i.f.

As previously stated, there is still a large make in progress in England and Scotland, but the quality has been somewhat irregular in some districts.

Butter.—There has been a steady consumptive demand throughout the month, dealers preferring to operate from hand to mouth at present prices. By the end of the month prices had advanced 3*s.* to 5*s.* per cwt. on some descriptions. Arrivals from Siberia have not been quite so heavy, and higher prices have been demanded in Siberia, the quality continuing good. Further shipments of the new season's Australian and New Zealand makes are now on passage, as well as several parcels of stored Australian, mostly consigned. The prospects in both these countries are for a large make during their coming season. Shipments from Canada continue small, as prices are high. The total for the season to the middle of August was only 15,000 packages.

Eggs.—The demand has been good, but chiefly for best selections, this description showing advances by the end of the month, whereas secondary lots were difficult to sell at the reduced prices. The shipments from Canada this season will be practically nil. In 1901 that country sent us 231,532 cases, each case containing 360 eggs.

THE FRUIT CROP IN THE WISBECH DISTRICT.

H. AMOS.

The show of blossom in the Wisbech district was very good for gooseberries, strawberries, apples, plums, &c., and early in the season it was anticipated that there would be a glut of fruit. In consequence, several fruits were quoted in advance at very low prices, but subsequently there was a marked improvement, and, on the whole, prices have been good.

Gooseberries.—The marketing of gooseberries commences in bulk about June 28th, and the price began at £10 10*s.* per ton, as against £5 10*s.* for the corresponding week of 1909. It was quite noticeable from the first what small quantities were being sent away daily, and it seemed understood that the above price would be maintained throughout the season; as a matter of fact, it was never less than £9, although some gooseberries may have been purchased very early at lower prices. What few tons were left on the trees to be sold as "ripe berries" made £10 quite easily, and in some places even more.

The best gooseberry grown here is the Crown Bob, Whinham's Industry being second, while the Careless is becoming very popular.

Strawberries.—Strawberries at first made an extremely good show of bloom, and looked like being a bumper crop; consequently prices

commenced under the average. The first pickings in Wisbech commence when strawberries from Hampshire are well in, and consequently the Wisbech growers do not get the 6*d.* and 7*d.* per lb. which is obtained by the earlier Hampshire consignments. Jam strawberries opened very quiet, and were difficult to sell at £12 per ton f.o.r. Wisbech. This price is a poor one, as the grower has £4 13*s.* 4*d.* to pay for picking. Many jam-makers did not buy even at that price, hoping to purchase later on at a lower figure. In this they were disappointed, as Paxtons, after the first picking, were practically finished, and in three days jam strawberries rose from £12 to £18, and later to £20 per ton, and were in great demand. Growers finished up very well, and the demand is likely to affect the price next season, so that jam fruit should not commence under £16 per ton.

Apples.—The crop of apples of all kinds has been a failure, and the available produce is making a very high price; as an example, Bramley's Seedling is worth £15, Lord Derby £14, Grenadier, Lane's Prince Albert and Lord Suffield, £12, Emneth Earlier and Grosvenor, £10 per ton. Amongst the dessert apples, Beauty of Bath realised £16, Worcester Pearmain, £18, and Gladstone, £14, per ton. Stocks are very limited, and are keenly sought after. Jam apples in bags are very firm at £5 10*s.* per ton, merchants taking in any quantity over 1 cwt. lots.

Plums.—Plums are also a very short crop, Early Rivers commencing and finishing at not less than £15 per ton. The quality was very good. Czars also remained firm at £15 per ton, and showed plenty of size. Early Victorias are very thin crops, and have been bought up on all sides at £18 per ton; they are of exceptionally good quality. Belle de Louvain and Ponds' Seedling are also scarce, and are selling at £16 and £18 per ton. Altogether the plums are a poor half crop, but will realise much more than had there been a full crop. Wisbech growers would do well to plant Egg Plums and Kentish Bush Plums.

Pears.—Hazel pears are grown extensively in places about Wisbech, but the crop this year is very poor indeed, and prices are not likely to fall below £9 per ton.

Raspberries.—Raspberries showed an enormous lot of bloom, and prices commenced very badly, the chief cause being the low quotations sent out by the Blairgowrie growers, who sold hundreds of tons very early at £10 per ton; this greatly stopped the sale, and plenty were sold at £11. Prices gradually rose, and raspberries finished firm in Wisbech at £18 per ton. The best varieties grown here are Superlative, which bears transport well and is useful at first for selling in chip baskets, and Baumforth's Seedling, a very bright-coloured raspberry. This does not bear carriage quite so well as other sorts do.

Currants.—Red currants generally realise a poor price here, usually making £9 to £11 per ton. This year £18 was paid quite freely for Dutch Red, and Red Grape realised £20. As a great many red currants are grown in the district growers have done a good business. Black currants are not grown very largely, but what did come on the market made £28 per ton to commence with, and finished at £45. Taking the season altogether, growers have had a much better experience than during the last two years.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and SCOTLAND in the Month of August, 1910.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	England. First Quality.	England. Second Quality.	Scotland. First Quality.	Scotland. Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per cwt.†	per cwt.†
Cattle:—	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Polled Scots	9 1	8 7	44 0	39 10
Herefords	9 1	8 5	—	—
Shorthorns	8 10	7 11	43 1	38 9
Devons	9 1	8 1	—	—
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	*d.*	*d.*	*d.*
Veal Calves	$8\frac{1}{4}$	$7\frac{1}{2}$	$8\frac{1}{2}$	7
Sheep:—				
Downs	8	7	—	—
Longwools	$7\frac{1}{2}$	$6\frac{3}{4}$	—	—
Cheviots	8	$7\frac{1}{2}$	$8\frac{1}{2}$	$7\frac{1}{4}$
Blackfaced	8	$7\frac{1}{2}$	$7\frac{3}{4}$	$6\frac{3}{4}$
Cross-breds	8	$7\frac{1}{4}$	$8\frac{1}{2}$	$7\frac{1}{2}$
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs:—	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Bacon Pigs	8 2	7 9	8 2	7 3
Porkers	8 6	8 0	8 5	7 6
LEAN STOCK:—	per head.	per head.	per head.	per head.
Milking Cows:—	£ *s.*	£ *s.*	£ *s.*	£ *s.*
Shorthorns—In Milk ...	22 0	18 11	22 10	18 3
,, —Calvers	20 19	18 3	20 15	17 4
Other Breeds—In Milk ...	20 6	15 15	19 18	16 11
,, —Calvers ...	16 10	14 0	19 16	16 11
Calves for Rearing	2 10	1 16	2 12	1 13
Store Cattle:—				
Shorthorns—Yearlings ...	10 7	9 2	10 14	8 9
,, —Two-year-olds...	14 13	12 15	14 19	12 14
,, —Three-year-olds	18 0	15 7	19 2	14 15
Polled Scots—Two-year-olds	—	—	17 4	14 9
Herefords— ,,	15 0	14 1	—	—
Devons— ,,	14 8	12 11	—	—
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Downs or Longwools ...	30 9	26 5	—	—
Scotch Cross-breds ...	—	—	26 8	21 11
Store Pigs:—				
Under 4 months	33 8	26 5	26 2	19 11

* Estimated carcass weight.
† Live weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND and SCOTLAND in the Month of August, 1910.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Quality.	Birmingham.	Liverpool.	London.	Manchester.	Edinburgh.	Glasgow.
		per cwt. *s. d.*	per cwt. *s. d.*	per cwt. *s. d.*	per cwt. *s. d.*	per cwt. *s. d.*	per cwt. *s. d.*
BEEF :—							
English	1st	60 0	—	61 6	59 0	65 6*	67 6*
	2nd	56 0	—	57 6	56 6	59 0*	63 0*
Cow and Bull ...	1st	52 6	49 0	50 6	51 6	48 6	56 0
	2nd	45 0	43 0	45 0	46 6	41 6	42 0
U.S.A. and Canadian :—							
Port Killed ...	1st	57 0	59 0	61 6	59 0	—	63 0
	2nd	55 0	54 0	57 6	55 0	—	59 0
Argentine Frozen—							
Hind Quarters...	1st	34 0	33 0	33 0	33 0	34 6	37 6
Fore ,, ...	1st	29 0	27 6	27 0	27 6	28 6	29 6
Argentine Chilled—							
Hind Quarters...	1st	48 0	48 0	48 6	48 6	49 6	49 0
Fore ,, ...	1st	35 6	32 6	34 6	32 6	36 6	35 0
American Chilled—							
Hind Quarters—	1st	—	64 0	63 6	64 0	65 0	—
Fore ,, ...	1st	—	46 0	44 6	45 6	45 6	—
VEAL :—							
British	1st	60 6	70 6	73 0	69 0	—	—
	2nd	51 6	65 6	66 6	64 0	—	—
Foreign	1st	—	—	74 0	—	64 0	—
MUTTON :—							
Scotch	1st	—	—	69 6	—	62 6	70 0
	2nd	—	—	66 0	—	55 6	53 0
English	1st	64 6	65 6	63 0	64 6	—	—
	2nd	53 6	60 6	59 0	60 6	—	—
Argentine Frozen ...	1st	33 0	32 0	32 0	31 6	34 0	32 6
Australian ,, ...	1st	31 0	28 6	29 6	28 6	—	32 0
New Zealand ,, ...	1st	—	—	35 6	—	—	—
LAMB :—							
British	1st	65 6	66 6	70 6	67 6	64 0	73 6
	2nd	60 6	62 0	65 6	63 0	—	55 0
New Zealand ...	1st	51 6	48 6	48 6	49 0	52 0	51 6
Australian	1st	46 0	42 6	44 0	42 6	—	46 0
Argentine	1st	45 0	42 6	41 0	42 6	42 0	46 6
PORK :—							
British	1st	69 0	64 6	67 6	70 0	66 0	66 6
	2nd	63 0	59 6	62 6	65 6	60 0	64 6
Foreign	1st	—	—	66 0	—	—	—

* Scotch.

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1908, 1909 and 1910.

Weeks ended (*in* 1910)	WHEAT.						BARLEY.						OATS.					
	1908.		1909.		1910.		1908.		1909.		1910.		1908.		1909.		1910.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Jan. 1 ...	35	1	32	0	33	3	26	9	26	7	25	1	18	4	17	4	17	4
„ 8 ...	35	2	32	9	33	6	26	9	26	11	24	11	18	3	17	5	17	2
„ 15 ...	35	5	32	8	33	8	27	1	27	1	24	11	18	5	17	5	17	7
„ 22 ...	35	6	33	2	33	9	26	11	27	3	24	11	18	5	17	8	17	6
„ 29 ...	35	0	33	0	33	6	26	11	27	6	25	0	18	4	17	9	17	4
Feb. 5 ...	34	3	33	4	33	7	26	9	27	7	24	10	18	3	17	10	17	7
„ 12 ...	33	1	33	8	33	4	26	9	27	8	24	9	18	0	17	11	17	11
„ 19 ...	32	6	34	1	33	0	26	5	27	11	24	6	17	11	18	0	18	0
„ 26 ...	30	11	34	5	32	7	26	3	28	0	24	2	17	8	18	0	17	10
Mar. 5 ...	30	5	34	10	32	7	26	1	27	11	24	6	17	8	18	2	18	1
„ 12 ...	31	3	35	8	32	6	26	0	28	4	24	1	17	10	18	2	18	0
„ 19 ...	31	7	35	9	32	6	26	2	28	0	23	6	17	11	18	5	18	0
„ 26 ...	31	4	36	0	32	9	25	10	28	0	23	7	17	10	18	6	17	11
Apl. 2 ...	31	3	36	5	33	0	25	5	27	10	23	8	17	9	18	8	18	0
„ 9 .	31	2	37	4	33	6	25	10	28	0	23	1	17	7	18	10	17	11
„ 16 ...	30	11	38	7	33	7	26	1	27	8	23	5	17	7	19	2	18	3
„ 23 ...	30	10	41	4	33	7	25	5	28	2	23	0	17	9	19	9	18	3
„ 30 ...	31	6	42	5	33	0	25	8	27	10	22	10	18	0	20	0	18	3
May 7 ...	32	4	40	9	32	6	25	5	27	7	22	7	18	4	20	3	18	2
„ 14 ...	33	1	41	6	32	1	24	9	27	3	22	0	18	7	20	6	18	1
„ 21 ...	33	8	42	8	31	10	25	9	27	0	21	8	18	10	20	11	17	8
„ 28 ...	33	5	42	6	31	3	24	6	26	3	21	4	18	8	21	0	17	10
June 4 ...	33	1	43	1	30	2	25	10	25	7	21	8	18	4	21	3	17	10
„ 11 ...	32	7	42	11	29	1	24	5	26	10	20	9	18	4	21	4	17	10
„ 18 ...	32	0	42	7	29	0	24	2	26	10	18	11	18	5	21	6	18	0
„ 25 ...	31	5	42	8	29	4	24	0	27	2	20	1	18	7	21	7	17	9
July 2 ...	30	11	42	9	29	9	23	11	27	2	19	11	18	7	21	9	17	7
„ 9 ...	30	5	43	0	30	4	24	4	26	4	19	5	18	5	21	8	17	4
„ 16 ...	30	7	43	3	31	1	23	1	26	10	21	3	18	5	21	9	17	7
„ 23 ...	31	5	44	0	31	11	26	5	27	4	19	9	18	6	22	5	17	5
„ 30 ...	31	10	43	5	33	5	24	4	24	6	20	10	18	7	22	2	18	1
Aug. 6 ...	31	6	44	9	33	9	23	1	27	4	20	5	18	9	22	11	18	3
„ 13 ...	31	6	44	9	33	5	23	10	24	9	20	4	18	1	21	8	18	0
„ 20 ...	31	2	41	6	32	11	24	5	23	11	20	11	17	10	19	8	17	11
„ 27 ...	30	10	38	5	32	7	24	5	24	7	20	10	17	1	19	4	17	2
Sept. 3 ...	30	10	37	2	32	2	25	5	26	3	22	10	17	3	19	6	17	2
„ 10 ...	31	5	34	11			25	11	26	1			17	6	18	5		
„ 17 ...	31	7	33	6			26	0	26	5			17	3	17	9		
„ 24 ...	31	5	32	9			26	8	26	8			17	2	17	7		
Oct. 1 ...	31	7	32	2			26	11	26	9			17	2	17	2		
„ 8 ...	31	5	31	8			27	5	26	9			17	0	17	0		
„ 15 ...	31	2	31	4			27	6	27	0			17	0	17	0		
„ 22 ...	30	11	31	8			27	5	27	7			16	11	16	11		
„ 29 ...	30	8	31	10			27	5	27	9			16	11	17	0		
Nov. 5 ...	30	11	32	5			27	6	27	9			17	0	17	0		
„ 12 ...	31	2	32	5			27	4	27	7			17	0	17	1		
„ 19 ...	31	10	32	7			27	3	27	0			17	3	17	4		
„ 26 ...	32	3	33	0			27	2	26	8			17	5	17	3		
Dec. 3 ...	32	7	33	3			27	2	26	1			17	4	17	4		
„ 10 ...	32	8	33	3			27	0	25	7			17	4	17	3		
„ 17 ...	32	9	33	2			26	9	25	3			17	3	17	4		
„ 24 ...	32	2	33	1			26	8	25	2			17	2	17	4		

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lbs.; Barley, 50 lbs.; Oats, 39 lbs. per Imperial Bushel.

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE, BELGIUM, and GERMANY, and at PARIS, BERLIN, and BRESLAU.

—		Wheat.		Barley.		Oats.	
		1909.	1910.	1909.	1910.	1909.	1910.
		s. *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
France:	July	44 1	42 10	28 2	25 4	24 8	21 1
	August	41 6	45 8	27 0	25 4	22 10	21 3
Paris:	July	45 8	45 6	29 8	23 6	26 11	21 7
	August	42 6	48 10	29 2	23 11	24 8	22 1
Belgium:	June	45 5	31 11	25 11	22 8	25 5	19 8
	July	48 0	33 10	26 1	22 4	26 8	20 2
Germany:	June	56 10	40 5	29 11	24 3	27 3	20 1
	July	58 2	41 11	29 9	24 3	28 4	20 11
Berlin:	June	57 5	42 9	—	—	26 6	20 5
	July	55 10	45 4	—	—	25 3	21 0
Breslau:	June	57 7	39 7	32 6 (brewing) 26 0 (other)	25 4 (brewing) 22 11 (other)	26 3	19 3
	July	58 4	40 11	— (brewing) 26 0 (other)	— (brewing) 22 11 (other)	26 7	19 8

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*, the prices for the German Empire representing the average of the prices at a number of markets.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of August, 1909 and 1910.

—	Wheat.		Barley.		Oats.	
	1909.	1910.	1909.	1910.	1909.	1910.
	s. *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
London	42 8	33 3	—	21 3	18 0	18 5
Norwich	44 1	32 11	—	21 6	22 3	17 9
Peterborough	39 5	32 6	—	21 4	22 3	17 8
Lincoln	44 5	33 0	—	—	21 5	18 7
Doncaster	45 5	33 2	—	21 0	22 4	18 10
Salisbury	38 10	33 7	22 6	21 1	20 5	17 5

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND and SCOTLAND in the Month of August, 1910.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Bristol.		Liverpool.		London.		Glasgow.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12lb.
British ...	13 0	12 0	—	—	12 6	11 3	14 0	—
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery	110 6	109 0	108 0	105 0	111 0	107 6	109 6	—
,, Factory	101 6	97 0	98 0	91 0	103 0	97 0	—	—
Danish ...	—	—	116 0	114 0	115 0	113 0	115 0	—
French ...	102 0	96 0	—	—	110 0	106 6	—	—
Russian ...	105 6	99 0	103 0	100 6	103 0	97 0	104 0	99 6
Australian ...	110 0	105 0	—	—	104 0	102 0	—	—
New Zealand	116 6	108 6	—	—	—	—	—	—
CHEESE :—								
British—								
Cheddar ...	74 0	63 6	70 0	66 0	75 6	70 0	57 0	53 0
			120 lb.	120 lb.	120 lb.	120 lb.		
Cheshire ...	—	—	64 6	60 0	72 6	63 6	—	—
			per cwt.	per cwt.	per cwt.	per cwt.		
Canadian ...	55 0	53 0	54 6	53 0	54 6	53 6	55 0	53 0
BACON :—								
Irish	83 6	80 6	82 6	78 6	82 0	79 0	86 0	83 0
Canadian ...	78 6	75 6	76 0	73 0	77 0	75 6	79 6	78 0
HAMS :—								
Cumberland ...	—	—	—	—	108 0	103 0	—	—
Irish	—	—	—	—	108 0	99 0	105 0	102 0
American (long cut) ...	83 0	77 0	81 6	75 6	81 0	76 6	80 6	78 6
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British ...	11 8	10 10	—	—	12 3	11 0	—	—
Irish	10 2	9 5	10 2	9 4	10 5	9 8	10 6	9 10
Danish ...	—	—	10 0	9 6	10 8	9 0	10 3	9 0
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Sir John Llewellyn	65 0	60 0	61 6	55 0	60 0	55 0	—	—
Other First Earlies	75 0	65 0	—	—	56 6	51 6	56 6	53 6
British Queen.	70 0	65 0	51 6	46 6	58 6	51 6	—	—
HAY :—								
Clover ...	95 0	80 0	87 6	61 0	93 6	78 0	77 6	70 0
Meadow ...	80 0	65 0	—	—	83 0	62 0	—	—

DISEASES OF ANIMALS ACTS, 1894 to 1910.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	AUGUST.		EIGHT MONTHS ENDED AUGUST.	
	1910.	1909.	1910.	1909.
Swine-Fever:—				
Outbreaks	90	106	1,000	1,249
Swine Slaughtered as diseased or exposed to infection ...	619	809	8,858	10,995
Anthrax:—				
Outbreaks	93	80	999	905
Animals attacked	107	108	1,206	1,211
Foot-and-Mouth Disease:—				
Outbreaks	—	—	2	—
Animals attacked	—	—	15	—
Glanders (including Farcy):—				
Outbreaks	36	29	255	375
Animals attacked	121	66	776	1,360
Sheep-Scab:—				
Outbreaks	10	7	339	471

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)

DISEASE.	AUGUST.		EIGHT MONTHS ENDED AUGUST.	
	1910.	1909.	1910.	1909.
Swine-Fever:—				
Outbreaks	4	7	71	82
Swine Slaughtered as diseased or exposed to infection ...	67	183	1,698	1,505
Anthrax:—				
Outbreaks	—	2	5	5
Animals attacked	—	2	8	5
Glanders (including Farcy):—				
Outbreaks	—	—	1	—
Animals attacked	—	—	2	—
Sheep-Scab:—				
Outbreaks	5	—	348	305

ADDITIONS TO THE LIBRARY.

[NOTE.—The receipt of *annual* publications of foreign agricultural and other departments, experiment stations and societies is not noted in the monthly list of additions to the Library. A list of these publications appeared in the *Journal* for October, November, and December, 1909.]

Agriculture, General and Miscellaneous—

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Japan, Department of Education.—Education in Japan (238 pp.). History of Japanese Education (91 pp.). 1910. Tokyo, Japan. [B. 44.]

Transvaal Department of Agriculture.—Farmers' Bulletins. No. 118:—The Rotation of Crops for Irrigated Lands (8 pp.). [B. 8.] No. 120:—The Principles of Land Settlement (8 pp.). [A. 68.] Pretoria, 1910.

Memoirs of the Geological Survey, England and Wales.—The Water Supply of Oxfordshire, with Records of Sinkings and Borings (108 pp.). 2*s*. 6*d*. Summary of Progress of the Geological Survey of Great Britain and the Museum of Practical Geology for 1909 (92 pp.). 1*s*. London: E. Stanford, 1910. [B. 38.]

Macdonald, W.—Dry-Farming: Its Principles and Practice (290 pp.). London: Werner Laurie, 1909. 6*s*. net. [B. 8.]

U.S. Department of Agriculture, Bureau of Plant Industry.—Circ. 60:—Suggestions to Settlers on the Sandy Soils of the Columbia River Valley (23 pp.). Washington, 1910. [A. 80.]

U.S. Department of Agriculture, Bureau of Chemistry.—Bull. 113 (Revised):—Injury to Vegetation and Animal Life by Smelter Wastes (61 pp.). Washington, 1910. [B. 22; E. 20.]

Netherlands, Departement van Landbouw.—Verslagen en Mededeelingen van de Directie van den Landbouw, 1910, No. 4:—Verslag over den Landbouw in Nederland over 1909 (132 pp.). The Hague: J. and H. van Langenhuysen, 1910. 50 c. [A. 25.]

Recent Progress in Korea (compiled by H.I.J.M.'s Residency-General) (122 pp.). n.d. [A. 62.]

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Field Crops—

U.S. Department of Agriculture, Bureau of Plant Industry.—Circ. 61:—Dry-Land Grains in the Great Basin (39 pp.). Washington, 1910. [C. 22.]

Aberdeen and N. of Scotland College of Agriculture.—Leaflet No. 9:—Report on the Effects of the New Nitrogenous Manures on Potatoes and Hay (7 pp.). [C. 26; C. 42.] Leaflet No. 10:—Report on Oat and Barley Experiments, 1909 (6 pp.). [C. 16; C. 8.] Leaflet No. 11:—Report on Turnip Manuring Experiments, 1909 (6 pp.). [C. 32.] Aberdeen, 1910.

Canadian Department of Agriculture, Tobacco Division.—Bull. A. 8:—Experimental Work, 1909 (24 pp.). Ottawa, 1909. [C. 54.]

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Wright, J.—Profitable Fruit Growing. Ninth edition. (127 pp.) London: W. H. and L. Collingridge, 1910. 1*s.* [D. 28.]

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THE SCOURING LANDS OF SOMERSET.

C. T. GIMINGHAM, F.I.C., University of Bristol.

In certain districts of the centre part of the county of Somerset, pastures occur which produce herbage with the property of causing cattle to scour very seriously indeed. Such scouring pastures are known locally as "teart" or "tart" land. Somerset is essentially a dairy country, and "teart" pastures detract considerably from the value of the land, so that the subject becomes one of considerable economic importance.

Historical.—The peculiarities of scouring land have attracted the attention of scientific agriculturists from time to time, but the literature on the subject is scanty. It is somewhat surprising to find that there is no mention of this type of land in Mr. John Billingsley's Report to the Board of Agriculture on "The Agriculture of the County of Somerset," published in 1798, though the district where the "teart" lands now occur is discussed at considerable length. However, a good deal of this land at that time was under arable cultivation.

The first mention of "teart" land, so far as the writer is aware, is to be found in an essay by Mr. Aubrey Clarke * published in 1855, and the next is a Report by the late Dr. Augustus Voelcker—"On the Scouring Lands of Central Somerset"—who undertook an investigation at the request of the Council of the Bath and West Society in 1862.† This is a most valuable and comprehensive report, and the results

* Journ. Bath and West Soc., Vol. iii., p. 52, 1855.
† Journ. Bath and West Soc., Vol. x., p. 183, 1862.

discussed in this article, arrived at from a different point of view, bear out to some extent the suggestions put forward by Dr. Voelcker.

The subject was then apparently left untouched until 1896, when the Bath and West Society took up the work again. A series of field experiments was planned and carried out at two centres in the "teart" land district, and analyses of herbage, soils, &c., were made. Owing, however, to the particular weather conditions during those seasons, the fields chosen did not act up to their reputation as scouring lands, and no very decisive results were arrived at. An account of these experiments will be found in the *Journal* of the Bath and West Society from 1896–1903.

The Characteristics of "Teart" Land.—At the outset it would seem important to ascertain the actual acreage of pasture land which possesses scouring properties, and the extent to which the value of such land is depreciated. But here a difficulty comes in. The herbage of scouring fields varies greatly in different places with regard to the extent to which "teartness" is developed, so that all fields which are known as "teart" can by no means be put down as of equal value. In certain seasons, too, the same field will scour cattle much less than in others; indeed, in very dry summers scouring from this cause is only occasionally heard of. Again, the scouring pastures in most districts are intermixed with perfectly sound fields; and it is not common to hear of a farm on which the *whole* of the pasture has the reputation of being "teart." Thus the depreciation in value of the "teart" fields affects the rent of the whole farm, and it is hardly possible to assign the share of the "teart" land in determining what the rent is to be. These facts make any estimate of the actual amount of pecuniary loss due to the presence of scouring land of little or no value.

Moreover, only the very roughest approximation is possible with regard to the total acreage affected.

Very roughly, the "teart" land area may be said to be bounded by a line drawn through Glastonbury, Evercreech, Sparkford, and thence a little south of Ilchester, as far west as Hatch Beauchamp, and back through Langport and Somerton to Glastonbury. To this must be added a broad strip of land

running through Butleigh, Street, Walton, Edington, to Cossington. If we refer to the geological map of Somerset, it will be noticed that this line also marks approximately the boundaries of the Lower Lias formation, and it is here that the "teart" land is found.

There are also a number of smaller areas in the midst of sound land, mostly lying to the north of the main area indicated above, *e.g.*, the districts of Meare, Mark, Stone Easton; and a tract of land immediately to the south of Bristol, surrounding Dundry Hill, where the land undoubtedly has a tendency to scour, though it is not here a very serious matter. Thus a considerable part of mid-Somerset is involved; at a rough computation the whole area may be put down at about 20,000 acres; and though by no means every pasture in these districts is "teart," yet so much of the land at certain seasons is unfit for feeding cattle that the value of the great majority of the farms is very seriously lessened.

Variability.—It is not always a simple matter to define what should be called "teart" land. In many cases the effect on cattle is only too obvious, but there are numerous fields just on the border line which in one district would be considered "teart" and in another quite sound, depending on the degree of "teartness" in the vicinity. In some places scouring and sound pastures occur side by side, and there is a sharp change from one to the other; but elsewhere there is a gradual transition from sound to scouring land, and then there is difficulty in determining where the one stops and the other begins. Again, one can find land undoubtedly producing herbage with a scouring tendency, and therefore "teart" in a mild degree, but yet not bad enough to affect the health of cattle seriously; whereas in some places it is quite impossible to graze yearlings or dairy cows or to rear a calf. Briefly, it may be said that there are a few localities where the "teart" land is so bad that it is impossible to keep cattle of any kind in the pastures at certain times of the year without risk of permanent injury to them; while over a considerable area the animals never do well, and it is only possible to prevent them from "going back" by feeding with cotton-cake and hay.

The varying degree to which the characteristic properties of "teart" land may be developed in different places and under different conditions helps to explain the very various opinions which have been expressed as to the seriousness of the problem. It is true that in certain seasons the "teart" fields do not scour cattle to any very grave extent; but that the occurrence of "teart" land on a farm on the whole involves very great inconvenience and loss both to the landlord and tenant there can be no doubt.

It is thus important to realise the variable nature of "teart" land; and in the following description of its properties and characteristics it must not be concluded that every statement is applicable to every scouring field in the same degree.

Effect on Cattle.—The effect on cattle turned into a "teart" pasture is manifest in a few days—often within twenty-four hours, and it is always most noticeable in the spring and autumn. The dung becomes very loose and watery, and the animals get into a filthy condition; later, the dung becomes light-coloured and full of bubbles. It is a real scouring. In a short time the animals begin to lose flesh, become "pile-haired," and go out of condition altogether. The writer is told that if cows are left any long period in a bad "teart" field when the herbage is scouring, they become very emaciated and will "scour themselves to death." It is a curious fact that a dark-red Devon cow, if allowed to feed in "teart" pastures, will gradually turn to a muddy yellow colour. The symptoms do not, on the whole, seem to suggest a specific disease; and, indeed, it seems not impossible that the scouring due to "teart" land may be simply a much aggravated case of the slight scouring which occurs occasionally on many types of land.

All kinds of cattle are affected, but cows in milk are the worst sufferers, quickly becoming very ill and ceasing to yield the normal amount of milk. Lambs up to about a year old are also liable to scour. Fortunately, sheep and horses do not appear to be susceptible; but the "teart" lands being part of an important cheese-producing and milk district, dairy cows are the principal live stock.

On farms where there is sound land as well as "teart" land, if it is necessary to turn the cattle into the "teart" fields,

they are allowed to remain for a short time only, or they are fed heavily at the same time with cotton-cake, which partly counteracts the effects of the herbage. If the scouring is not permitted to go too far, the animals soon recover when transferred to sound land, particularly if they have some extra hay or cake. On the other hand, cattle may be so seriously pulled down through remaining long on this land that there is a permanent deterioration and they never completely recover. It must be noted, too, in discussing the effect of scouring land on cattle, that the constitution of each individual animal is an important factor. Farmers with "teart" land are obliged to exercise the greatest care in buying their animals, so as to choose only those of the soundest and strongest constitutions. Further, animals which have been bred on "teart" land farms are more likely to suffer badly than those from sound land.

The Water Supply.—Scouring on "teart" land has frequently been put down to the water supply; and, indeed, springs highly charged with mineral salts which possess aperient properties do occur in some "teart" fields. Such water is liable to scour cattle drinking it. On the other hand, many fields, though supplied with perfectly good water coming from a different geological formation, are none the less very "teart." All that can be concluded is that, though in certain places the drinking water may make matters worse, yet the provision of good water *by itself* is not the cure.*

The Influence of Manures.—Inquiries show that the application of manures to "teart" pastures results, as has been stated by previous observers, in an increase of the trouble. Probably this is simply because it increases the rapidity and amount of growth, since it is always in seasons of greatest and most rapid growth that scouring is most serious; and, on the contrary, in seasons of slow regular growth it is not so evident.

In this connection it is perhaps appropriate to note that many farmers consider that sheep have a considerable influence on "teart" land. The more the land is grazed by

* I should like, however, to point out that one of the late Dr. Voelcker's recommendations, given in the report above referred to, was that it is highly advisable to provide cattle with soft drinking water on "teart" lands in place of the natural springs. Mr. Aubrey Clarke also lays considerable stress on this point.

sheep, the worse it gets; if sheep are kept away, it improves somewhat. Now since, except in the worst seasons, sheep do well on scouring land, it is naturally a common practice in the management of such land to keep a good many sheep on it. Cases are reported in which very "teart" pastures which have been heavily grazed with sheep for many years have been considerably improved (as regards tendency to scour) by keeping sheep away altogether for a time, and afterwards only making use of them to a very small extent.

Influence of Frost.—The remarkable action of frost in rendering scouring herbage harmless is a point of particular interest. The autumn-grown herbage on "teart" land is always most liable to cause scouring; but after the first two or three sharp frosts all "teartness" disappears, and cattle can be safely put into the fields. The earlier the sharp frosts come, the better for farmers with scouring land.

Hay from "Teart" Land.—It is difficult to get precise information with regard to the extent to which hay from "teart" land may cause scouring. The fact is that it depends on the district and on the season. From the worst "teart" land hay will nearly always scour beasts, though never so badly as the fresh grass; but on most farms the hay is considered practically harmless, especially if allowed to get somewhat old before feeding. By cutting the grass rather late or allowing the hay to heat a little, most scouring properties seem to be removed in any case, though the hay is always more likely to scour animals which have been feeding in "teart" fields than those from sound land.

The Nature of the Herbage.—Perhaps the theory put forward most frequently to account for "teartness" is that it is due to the presence of one or more particular species of plants, such as the purging flax (*Linum catharticum*) or the carnation grass (*Carex panicea*). There is, however, no reliable evidence whatever to be advanced in favour of this view; indeed, very careful search by many different observers has failed to discover any plant which is peculiar to or even unusually abundant in "teart" pastures.

The type of herbage in scouring fields may apparently vary to almost any extent. It is certainly never possible—even to anyone who has been familiar with the "teart" land

districts for many years—to say by an examination of a field whether it will scour or not. Very often scouring fields produce an abundant growth, and give the impression of bearing most excellent and nutritious herbage; on the other hand, some fields with a poor, weedy growth are notoriously "teart."

There can be little doubt that the actual cause of "teartness" lies in some abnormal property of the herbage, but the chemical examination of a large number of samples of grass from scouring fields, compared with samples from neighbouring sound fields, has failed to show any consistent peculiarity in the composition of the scouring herbage. Analyses, both of the dried grass and of the juice expressed from the fresh material, have been carried out, but it cannot be said that the figures obtained throw much light on the subject.

The Geology and the Soil of "Teart" Land.—In Somerset scouring land is entirely confined to one geological formation—the Lower Lias. The late Dr. Voelcker, in his Report in 1862,* states that scouring land may occur not only on the Lias formation, but wherever the subsoil is a heavy, tenacious clay, *e.g.*, on Oxford Clay or Oolite clays. The writer, however, has never been able to hear of pastures with properties quite similar to those of the "teart" lands of Somerset occurring outside that county, or on any formation except the Lias.† At all events, in Somerset the scouring land is confined to the Lower Lias clay with remarkable accuracy; and it is possible to trace the boundary of this formation in some places by inquiring which is "teart" and which sound land.

The most interesting cases of this sharp distinction are where the Alluvium adjoins the Lias clay, as it does at so

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* Journ. Bath and West Soc., Vol. x., p. 183.

† In some parts of Lincolnshire, notably the Vale of Belvoir, and in parts of Gloucestershire, the geological conditions are almost identical with those in the scouring districts of Somerset, *i.e.*, Lower Lias not much covered by drift. I am informed that in the Vale of Belvoir cattle do scour a good deal when first put on the strong pastures in the spring, or when turned on to luxuriant aftermath, but there are never serious complaints of damage from this cause. This tends to confirm the opinion that with the Somerset "teart" lands we are simply dealing with an exaggerated case of a normal occurrence in Lias pastures.

many points in Somerset. Here often, by crossing a stream or a ditch, it is possible to step from very "teart" to perfectly mild land which yields excellent pasturage for dairy cows. The surface soil on the two sides is usually entirely different, being much looser and better in texture on the good land, though often, not far below the deposit of Alluvium, there is the sticky blue or yellow clay subsoil, just as in the adjoining scouring land. Where the Alluvium occurs the land is usually known as "moor" land, and nearly all of it is liable to be flooded in winter.

The manner in which mild "moor" land and "teart" land occur intermixed is well seen at Kingsdon, near Somerton, where there is a patch of sound fields quite surrounded by scouring land; also near Meare, where there is an area of Lias clay, the pastures on which are nearly all "teart," surrounded by sound, mild, alluvial land, and here the deposit of Alluvium is peaty and of great depth. The scouring pastures are situated on rising land which is not covered by Alluvium, and which is not liable to flood.

It is not only where the Lower Lias gives place to Alluvium that the change from "teart" to sound land can be seen; the same thing occurs at the boundary between Lower Lias and Inferior Oolite in several places. Usually, however, the change is not so marked as at places where the Lias and Alluvium adjoin; "teart" land gives place to sound before the actual boundary (as marked on the geological map) is reached, probably because the Lower Lias formation begins to be obscured by Drift.

The chief characteristic common to the surface soil of all "teart" pastures is its stiff, unyielding, essentially "clayey" nature. Moreover, a superficial examination of the soils of many "teart" pastures of varying degrees of "teartness" leads to the conclusion that in the fields in which scouring is worst the surface soil is found to be most "clayey" and closest in texture. These points made it of importance to investigate the *physical* nature of the soils and the results forthcoming are of some interest.

It is important in discussing the physical nature of a soil to distinguish between its mechanical structure, as revealed by a mechanical analysis, and the actual physical condition

in the field. A mechanical analysis gives the proportion of the particles of various sizes existing in the soil, but takes no account of the state of aggregation of those particles; and it is on this that the texture (or physical condition) depends. That is to say, in a soil containing a large proportion of the finest grades of particles, the amount of aeration, the texture, &c., will depend almost entirely on whether these particles are aggregated into larger units or not. There are many factors which may exert an influence on the physical condition of a soil. Among others, the presence of abundance of organic matter or of calcium carbonate in a fine state of division causes the finest clay particles to adhere and form larger aggregates, and this will result in a looser texture and better aeration. The *physical condition* of a soil can therefore, to some extent, be altered and controlled by various means; but the mechanical composition cannot be changed except by actually adding sand or clay.

TABLE I.

	Edgarley.		Westhay.		Kingsdon.	
	Sound 1.	Teart 2.	Sound 5.	Teart 6.	Sound 11.	Teart 12.
Gravel (3 mm. to 1 mm. diam.) ...	—	—	0·07	1·06	—	—
Coarse sand (1 mm. to 0·2 mm.) ...	0·57	0·5	1·06	6·02	0·79	1·61
Fine sand (0·2 mm. to 0·05 mm.) ...	4·33	8·4	2·64	8·45	5·26	6·27
Silt (0·05 mm. to 0·01 mm.)... ...	11·23	13·8	5·79	11·16	9·37	10·35
Fine silt (0·01 mm. to 0·005 mm.) ...	28·68	26·46	19·14	27·35	29·68	25·96
Clay (below 0·005 mm.)	23·78	24·96	15·39	20·66	27·45	29·31
Moisture	9·34	8·78	12·78	6·53	7·00	5·94
Loss on ignition (organic matter) ...	19·84	14·53	40·97	15·59	19·00	17·11
Calcium carbonate	0·17	0·22	0·28	2·02	0·05	2·41
	97·94	97·65	98·12	98·84	98·6	98·96

No. 1.—"Blackacre"—"moor" land of open texture—good pasture for dairy cows.
,, 2.—Stiff clay land—poor weedy growth—very "teart."
A ditch or "rhyne" separates fields 1 and 2.
,, 5.—Very peaty loose texture "moor" land—quite black—good mild pasture.
,, 6.—Stiff clay land—good growth of herbage—very "teart."
One field separates 5 and 6.
,, 11.—Top 4 or 5 inches of soil of loose open texture—below this, clay—quite sound.
,, 12.—Same as 6.
Two fields separate 11 and 12.

In Table I. are given the figures for the mechanical analyses of the surface soil of three "teart" fields, each compared with soil from an adjoining sound field situated on

alluvial land; and these are typical of other examples. There is a great difference in texture between the "teart" and the sound soil in each case—always in favour of the latter; and this is particularly noticeable in the top 4 in. or 5 in.*

A comparison of the figures for each pair of fields does not, however, show any very great differences; but it is to be noticed that the percentage of organic matter is invariably higher in the samples from sound land, and this is undoubtedly the cause of the manifest difference in texture;† in fact, the greater amount of organic matter in these samples was indicated by their "feel" and by their darker colour. The figures for Nos. 5 and 6 are indeed widely different, but these differences are almost entirely due to the excessive proportion of organic matter in the sound field, and this is simply an extreme case. The point is, however, that between the "teart" land and adjoining sound *alluvial* land there is a great difference in physical condition, but remarkably little in mechanical structure.

TABLE II.

	Near Bishopsworth.		Northamptonshire.	
	Sound 7.	Teart 8.	Sound (Thrupp) 9.	Sound (Braunston) 10.
Gravel	0·77	0·47	0·44	0·89
Coarse sand...	1·53	2·24	28·21	23·24
Fine sand	19·26	5·76	23·60	20·34
Silt	20·06	8·62	9·29	9·59
Fine silt	24·73	23·06	13·72	16·13
Clay	16·56	34·63	14·13	16 77
Moisture	3·62	5·55	2·04	2·33
Loss on ignition (organic matter)..	11·80	16·46	6·63	9·02
Calcium carbonate	0 23	1·31	0·19	0·25
	98·56	98·10	98·25	98·56

Again, if we take a case in which a "teart" soil (on the Lower Lias) is compared with an adjoining sound field on the

* The analyses refer to samples taken to a depth of 9 inches.

† There is always a fair proportion of calcium carbonate in the soil of "teart" fields (see Table). This would be expected to exert a favourable influence on the texture. It does not, however, have its full effect, because apparently it is always present in comparatively large pieces, and not in a very finely divided condition.

Inferior Oolite, we find also an obvious difference in texture between the two soils. The figures for the mechanical analyses given in Table II. (Nos. 7 and 8) show that here we are dealing with an actual difference in mechanical composition, *i.e.*, there is a considerably greater proportion of the coarser grades of particles in the soil of the sound land. This difference in composition is quite to be expected where both soils are derived from the underlying rock as in this case, and accounts for the noticeable difference in texture, greatly in favour of the sound field. Still, from the evidence above it seems reasonable to suppose that the "teart" nature of the pasture is due to its particular physical condition, and not to the mechanical composition.

A further point is that, though there is a large area of the Lower Lias formation stretching right across the country, we do not hear of serious scouring outside Somerset. This is probably because, except in Somerset and to a slight extent in parts of Gloucestershire and Lincolnshire,* this formation is largely concealed beneath coverings of Boulder Clay, Sand, Gravel, and extensive beds of Glacial Drift.† Thus it is to be expected that the soils on the Lower Lias in Somerset will be essentially different from the soils on this formation in most other parts of the country, where it is covered by Drift.

Analyses Nos. 9 and 10 in Table II. illustrate this. They are the figures given by two samples of soil from the Lower Lias formation (Drift-covered) in Northamptonshire, where scouring it quite unknown. The composition is entirely unlike any of the "teart" soils given; and the comparative textures reflect this difference, these Northamptonshire soils being sandy loams.

Such considerations suggest strongly that it is the particular *physical condition* of the "teart" soils that is at the bottom of the trouble, although no doubt there are other factors involved at the same time. Moreover, whatever view of the actual cause of the production of scouring herbage be taken, it seems probable that it will be necessary to improve the

* Possibly also to some extent further North.

† The Jurassic Rocks of Britain. Vol. iii. By H. B. Woodward. (Memoirs of the Geological Survey.)

physical condition of the surface soil in order to find a remedy.

The question then arises: Is it possible to improve the physical condition of these soils? Here the results of the mechanical analyses are of value. They prove to be not widely different from those of the soils of some well-known *valuable* pasture land in other parts of the country. It seems certain, therefore, that it is not the actual mechanical composition of the soil which is at fault; and hence there is no inherent reason arising from the structure of the soil why improvement should not be possible. Further, there is reason to suppose that by altering the physical condition of the soil improvement *does* set in; and possible remedial measures which seem worth trying suggest themselves.

For example, when "teart" land is *ploughed up* and laid down again after an interval, the new pasture is not "teart" at first, but only gradually becomes so. There are, however, no experimental data available on this subject, and it is a matter of importance to find out any means of keeping such newly-laid-down pasture permanently sound.

Again, the possibility of improvement by means of *drainage* is worthy of attention. As has been mentioned, all pastures on the Lower Lias formation in Somerset do not scour cattle, and it is those fields in which the texture of the surface soil is most "clayey" and the stiff clay subsoil comes nearest to the surface which are the worst. Dr. Voelcker, writing in 1862, and referring to a case of two fields side by side, both on the Lower Lias formation, one scouring and the other sound, suggests that "the scouring field would be found to rest on a stiff, impervious clay subsoil, not very far removed from the surface; and in the sound field the subsoil would, in all probability, be of a much more porous character, or be found at a greater depth than that usually penetrated by the roots of grasses." Certainly there always seems to be more definite surface soil which is of looser texture and better aerated in the fields that do not scour, when compared with adjoining scouring land; such fields would in consequence be slightly better drained.

A great deal of the pasture land in Somerset was drained many years ago, but at a great depth (usually 4 ft. to

4 ft. 6 in.). Even such deep drainage has in some cases much improved "teart" land (as Dr. Voelcker also mentions), but, as a rule, it is of very little use in such a heavy clay soil.

It is, however, most probable that drainage *as near the surface as is practicable* would in very many cases improve the surface texture and decrease the tendency to produce scouring herbage. This is a point with regard to which careful experiments would give most useful information.

Two cases in support of the view that drainage near the surface would be valuable are of interest.

On one farm there is a small field which always yields sound herbage, and which is surrounded on all sides by fields which frequently scour cattle badly. The farmer calls it his "hospital field." The only possible explanation seemed to be that twenty or thirty years previously this field alone had been *drained* by open "cuts."

The other case is one in which considerable improvement as regards scouring has actually taken place in several fields which were drained at a depth of about 2 ft., although drains were already there at about 4 ft. 6 in.

Scouring on "teart" land must be due either to the abnormal chemical composition of the herbage directly affecting the animals or causing an unusual fermentation in the intestines, or to a specific organism, bacterial or protozoal. If we assume that the actual cause is chemical in nature, it is possible that the very close texture of the soil and consequent poor aeration lowers the respiration of the plant and causes the formation of unusual compounds. On the other hand, assuming a micro-organism to be primarily concerned, then we are led to the conclusion that it is the physical condition of the "teart" soils which renders those, and those only, a suitable habitat for the organism. The evidence on the whole seems in favour of the former alternative. This is not, however, the place to discuss these two hypotheses, but in either case it seems that we shall probably be driven to attempt to alter the physical condition of the surface soil in order to improve matters.

GREASE-BANDING OF FRUIT TREES.

FRED V. THEOBALD, M.A., F.E.S., &c.

The process of grease-banding to catch the wingless females of the Winter Moth (*Cheimatobia brumata*) has been in vogue many years. Some, perhaps the majority of growers, have found it successful; others have not.

In order to ascertain the cause of the reported failures, a number of experiments and observations have been made during the last six years, which have shown most clearly the great benefit to be derived from this system if it is properly carried out. This, as will be shown, applies to standard trees, but not to all bush trees. The three objects investigated have been:—(1) To find out what insects harmful to fruit trees are actually caught in the grease-bands, and the period of their appearance; (2) the best position to band the trees; and (3) the most successful class of grease to use.

With regard to the first point, practically no observations had previously been made; with regard to the second, there was some diversity of opinion; and with regard to the last, complaints have been general that the greases dry up too quickly, and that they have to be constantly renewed. This cannot always be done in wet weather, and the result is that a few wet days may allow the females to ascend over the dried bands.

Insects against which Grease-banding is Used.—The damage done by caterpillars to fruit trees is often very serious. Complete defoliation of plantations is by no means unusual, and this not only means a loss of crop, but a serious check to the growth of the trees.

There are a number of different species of caterpillars found feeding on fruit, foliage, buds, blossom, and even the rind of the shoots.* By far the worst are the Looper caterpillars or Geometers, the female moths being wingless. With the exception of defoliation by Lackey Moth in parts of Kent, the only other instances of similar damage which I have seen on a wide scale have been caused by the Winter Moth group. It is for these that grease-banding is used.

* A full account of these will be found in "The Insect and Allied Pests of Orchard, Bush and Hot-house Fruits, their Prevention and Treatment." F. V. Theobald. (1909.)

If the trees are mainly attacked by Tortrix larvæ, Lackey Moth, or other moths which have winged females, grease-banding is, of course, waste of money, even if a few Winter Moths do appear, for spraying will be necessary to kill the Tortrix, Lackey Moth, &c., and the same wash (arsenate of lead) will kill the Winter Moth caterpillars. The damage caused by the above insects with winged females is either small or local, and it will be found that grease-banding is nearly everywhere necessary.

The following moths of the wingless female group attack fruit trees:—

1. The Winter Moth (*Cheimatobia brumata*).
2. The Mottled Umber Moth (*Hybernia defoliaria*).
3. The Early Moth (*Hybernia rupicapraria*).
4. The March Moth (*Anisopteryx æscularia*).
5. The Pale Brindled Beauty (*Phigalia pilosaria*).
6. The Dotted Border Moth (*Hybernia progemmaria*).

The Winter Moth is by far the most general, and is most prevalent on apple, plum, cherry and pear, and nuts. The Mottled Umber Moth is usually most abundant in plantations surrounded by oak woods. It feeds on apple, cherry, pear, and nuts; now and again on other fruits. The Early Moth is especially prevalent on plum, but it occurs on other kinds of fruit. Its usual food seems to be blackthorn and whitethorn. The March Moth is found especially on plums and nuts, also on apple, whitethorn and blackthorn. The Pale Brindled Beauty occurs on apple and plum, near oak plantations, and on sloe. The Dotted Border Moth occurs on apple and plum, but I have only found it in grease-bands at Wye Court, and have never had any complaints of it. Its normal food-plants are oak, birch, &c.

All of these insects in their caterpillar stage feed on forest, woodland, and hedgerow foliage as well, and can never be exterminated from such places.

These and many other insects were taken on the grease-bands during the months under observation, as shown in the following tables:—

INSECTS CAUGHT IN GREASE-BANDS ON THREE APPLE AND THREE PLUM TREES.—1908–1909.

October.—Winter Moth, 29 females, 40 males; Mottled Umber,

1 female; Storm Flies (Stomoxys), 3; Midges (Chironomidæ), thousands; Apple Suckers, hundreds; Carabid Beetles, 7; Leaf Hoppers (Chloritæ), 107.

November.—Winter Moth, 74 females, 192 males; Mottled Umber, 2 females, 1 male. Owl Midges, 17; Midges, 70.

December.—Winter Moth, 7 females, 12 males; Chironomidæ, 50; Winter Gnats (Trichocera), not counted.

January.—Winter Moth, 12 females, 29 males; Early Moth, 7 females, 3 males; Winter Gnats (Trichocera), 300.

February.—Winter Moth, 3 females, 2 males; Early Moth, 29 females, 61 males; Dotted Border, 2 females; Pale Brindled Beauty, 9 males, 2 females; Flat-Bodied Moths (Depressaria), 7; Winter Gnats, 700.

March.—Dotted Border, 6 females, 7 males; March Moth, 2 females, 10 males; Pale Brindled Beauty, 7 females, 3 males; Storm Flies (Stomoxys), 3; Owl Midges, 174.

April.—March Moths, 13 females; Woodlice, 50; Julus Worms, 27; Honey Bees, 3; Fever Flies (Bibionidæ), 17; Apion Weevils, 17; Storm Flies (Stomoxys), 22; Owl Midges, 93; Mosquitoes, 7; Midges (not counted).

May.—Leaf Weevils (Phyllobius), 79; Winter Moth larvæ, 127; Woodlice, 10; Nemocoris Bugs, 7; Apion Weevils, 29; Click Beetles, 17; Owl Midges, 72; Fever Flies, 14; Chironomidæ (not counted); Tortrix larvæ, 12.

June.—Leaf Weevils, 397; Winter Moth larvæ, 230; Woodlice, 7; Winged Aphides, 70; March Moth larvæ, 29; Pug Moth larvæ, 3; Click Beetles, 29; Clouded Drab Moth larvæ, 2; Green Bugs (Lygus), 7; Apple Suckers, 200.

September.—Apple suckers, 302; Leaf Hoppers (Typhlocyba and Chloritæ) in countless numbers; Frog Hoppers, 27; Carabid Beetles, 7; Click Beetles, 3; Muscidæ, 105.

The last March Moths rose from the soil on April 15th, and the bands were destroyed May 20th. A new series of bands of various greases were used from May to September.

INSECTS CAUGHT IN GREASE-BANDS ON THREE APPLE, THREE PLUM, AND THREE NUT TREES.—1909–1910.

October.—Winter Moths, 12 females, 4 males; Apple Suckers, 500; Leaf Hoppers (Chloritæ), thousands; Honey Bees, 3.

November.—Winter Moths, 4 females, 20 males; Midges, some hundreds.

December.—Winter Moths, 50 females, 100 males; Mottled Umber, 2 females; Winter Gnats, 70; Julus Worms, 7.

January.—Winter Moths, 43 females, 70 males; Early Moth, 20 females, 7 males; Winter Gnats, hundreds.

February.—Early Moths, 17 females, 7 males; Pale Brindled Beauty, 2 males; Winter Gnats, 50; Owl Midges in numbers.

March.—Dotted Border Moth, 3 females and 1 male; March Moth, 47 females, 2 males; Owl Midges, hundreds.

April.—March Moth, 7 females; Pale Brindled Beauty, 1 female, 2 males; Honey Bees, 24; Fever Flies, 70; Storm Flies, 2; Owl Midges, 100; Mosquitoes, 24; Midges (not counted); Woodlice, 50; Julus Worms, 10; Centipedes, 3; Carabus Beetle, 1.

May.—Winter Moth larvæ, 300; Leaf Weevils, 50; Click Beetles, 4; Longhorn Beetles, 2; Owl Midges (not counted); Chironomidæ (not counted); Fever Flies, 71; Woodlice, 20; Small Weevils not identified, 30; Harvest Men (Phalangidæ), 23.

June.—Winter Moth larvæ, 170; Leaf Weevils, 10; Click Beetles, 7; Apple Suckers, hundreds; Muscidæ, 20; Ants in hundreds; Woolly Aphis, 50 (many sunk in grease and not counted).

These records for May and June apply to bands put on previously unbanded trees.

Relative Effect of High and Low Banding.—The position in which the banding is placed has long been a matter of controversy. Some people have advocated high, some low, banding. To investigate this matter the following experiments have been carried out.

Two lots of eight trees were banded as follows:—

Experiment A.—Bands placed 2 ft. from the ground and kept moist from October to April.

Experiment B.—Bands placed at 4, 5, and 5½ ft. from the ground, and the bands also kept moist.

On two trees in A., numerous Winter Moth larvæ occurred on the foliage. In B., none occurred at all. In A., 32 females and 117 males were caught, and in B., 70 females and over 100 males. In 1910 double bands were placed on one lot of trees, and whilst many females were caught on the lower A. bands, 15 were caught on the higher B. bands.

It seems, therefore, that a few females get over the low bands in some way. Although in what manner they do this was not traced by actual observation, there is little room for doubt but that the winged males can carry the females in copulâ some short distance, and deposit them on the trunks of the trees. From the results obtained, it seems that 4 ft. is a safe distance to allow to prevent them doing this.

In one instance, however, on a cherry tree, doubly banded at 2 ft. and 4 ft., a female was found on the top of the upper band just caught in the grease. It is possible that an occasional larva may pupate in an old tree in some branch junction. It was noticed that this female was evidently crawling downwards, as she was caught by the head. I searched for a pupal skin and cocoon, but could not detect one.

As low banding up to 2 ft. is not completely successful, it is very doubtful if the process pays its way in bush plantations. Several growers have informed me that caterpillars

appear when bush trees are banded, and they do not consider the method sufficiently successful to use. Further detailed trials are wanted before any definite statement can be made on this point.

On the other hand, banding is undoubtedly most essential with standards, which are less easily sprayed, and banding will make arsenical spraying to a large extent unnecessary. As yet we do not know the final effects of arsenical spraying over a long series of years. The insoluble arsenic collected in the soil may become soluble arsenic, and what injurious effect the soluble arsenic has is at present unknown. It is, however, a source of danger, and if we can reduce arsenical spraying by employing grease-banding more extensively and more accurately, so much the better.

Position where the Ova of Winter Moths are Deposited.—Normally the Winter Moth and its wingless female allies lay their eggs close to a bud or on a pruned surface, but any crevice or shelter may be selected. That is, they normally ascend right up into the trees before commencing to oviposit. Whether a change of habit has brought about an alteration in egg-laying, or whether keener observation has shown an old habit long unnoticed, we cannot say, but the fact remains that the females of the true Winter Moth will lay their ova far from the buds. The eggs have been frequently found, in the last four years, on the trunks of apple, pear, and cherry trees. This was first pointed out to me in Worcestershire whilst visiting Mr. Crane's orchards at Oakhampton. He noticed numbers of red eggs on the trunks of the cherry trees, and when we visited them a few days later there was no sign of the ova. The grease-bands were all more or less sticky, having recently been freshened up, and an examination of them at once revealed hundreds of small Winter Moth larvæ caught in the grease. Had the grease not been "tacky," the result of the banding would have been nil, for hundreds of hatched larvæ would have ascended the trees. On this account and from previous observations it was thought well to advise low banding, but subsequent experiments showed that this was not advisable.

During the last three years two pieces of cord by which the trees were tied to the stakes have been sent me covered with Winter Moth eggs, and in one instance the top

and crevices of a pole to which the tree was staked had hundreds of the ova upon it. The laying of ova upon the trunks of trees is much more common than is supposed.

These are important points to remember, for if we band high, which seems to be correct, we find many eggs may be laid below the bands, while on a staked tree, the eggs may be laid on the stakes and twine. Consequently, unless the bands are sticky all through March and April, the hatched-out larvæ would crawl over the dry bands and so reach the opening buds. That they try to do so was seen in Mr. Crane's orchard, and a similar case was noticed near Wye in 1909.

Many failures in grease-banding are due to the bands having been allowed to dry up in December or January. It is necessary to keep the banding "tacky" well over March, for Winter Moth alone, if we wish for success. The ova of the Mottled Umber Moth have also been seen on the trunks, laid singly, but many together. Those of the March Moth are always laid in bands around the twigs.

Eggs laid on the Grease-bands.—Large numbers of the green ova * are often seen in the grease on the bands. They have either been laid by the females whilst struggling in the grease, or may appear when their dead bodies have decayed. Several growers have written asking if these eggs would hatch out. Careful observations were made both upon the eggs on the bands in the open, and others taken off and kept indoors. In no case did any ova which had become coated with the grease hatch out.

Winter Moth Larvæ caught by Banding.—As seen in the two tables printed above of the insects caught in grease-bands during two seasons, numerous Winter Moth larvæ were caught in the summer. In all instances noted this was after heavy rain or wind, and the larvæ doubtless got knocked or shaken off, and in reascending the trunks were caught in the bands. In every case the larvæ were found on the lower part of the bands, very few had got near the top, and as far as could be seen none crossed any of the various greases experimented with when put on thickly.

In these cases the banding was put on experimentally in

* Winter Moth eggs are green when fresh, but become dull red later.

February, March, April, and May to test greases, and not to catch moths; consequently many females had ascended, and the larvæ were caught in May and June. It is not suggested that banding is to be used for this purpose; it is merely mentioned as an interesting fact. At the same time, we may bear in mind that if Winter Moth larvæ are shaken off, so may be many other larvæ, and thus the banding, if left on most of the year at no extra cost, will be of considerable benefit. On referring to the table of insects caught, it will be noticed that Tortrix larvæ and Clouded Drab Moth larvæ were caught in this way.

TABLE I.—1909–1910.

Grease.	*When put on.*	*October* 31.	*Examined November* 30.	*December* 31.
A. (British)	12/9/09	Moist	Moist	Moist
B. ,,	12/9/09	Dry 7/10/09	Quite dry	Dry
C. (German)	14/9/09	Moist	Moist	Dry on wind side
D. (British)	12/9/09	Dry 17/10/09	Quite dry	Dry
E. (Tanglefoot)	*12/9/09	Moist	Moist	Moist
F. ,,	6/1/09	Moist	Moist in places	Dry unless scraped
G. (British)	4/10/09	Moist	Moist	Drying up
H. (German)	4/10/09	Moist	Moist	Moist one side (washed off other)
I. ,,	5/10/09	Moist	Moist	Fairly moist
J. (British)	6/10/09	Moist	Moist	Fairly moist
K. ,,	6/10/09	Moist	Moist	Moist
L. ,,	14/10/09	Moist	Drying	Dry
M. (German)	7/11/09	—	Moist	Moist
O. ,,	7/11/09	—	Moist	Moist
P. ,,	12/11/09	—	Moist	Moist
Q. (British)	12/11/09	—	Moist	Dry

* These bands of Tanglefoot were put direct on the trees, and remained "tacky" for ten months. Mr. C. Smith, of Loddington, tells me his bands have remained so for over a year.

TABLE I.—1909–1910 (*Continued*).

Grease.	*When put on.*	*January* 31.	*Examined February* 28.	*Mar.* 31.	*Apr.* 30.
A. (British)	12/9/09	Drying	Still moist in places	Dry	Dry
B. ,,	12/9/09	Dry	Dry	Dry	Dry
C. (German)	14/9/09	Dry	Dry	Dry	Dry
D. (British)	12/9/09	Dry	Dry	Dry	Dry
E. (Tanglefoot)	18/9/09	Moist	Moist	Moist	Moist
F. ,,	6/1/09	Dry	Dry	Dry	Dry
G. (British)	4/10/09	Dry	Dry	Dry	Dry
H. (German)	4/10/09	Moist where left	Most gone	Gone	Gone
I. ,,	5/10/09	Dry	Dry	Dry	Dry
J. (British)	6/10/09	Dry in parts	Nearly dry	Dry	Dry
K. ,,	6/10/09	Nearly dry	Dry	Dry	Dry
L. ,,	14/10/09	Dry	Dry	Dry	Dry
M. (German)	7/11/09	Moist	Moist	Moist	Moist
O. ,,	7/11/09	Moist	Moist	Moist	Moist
P. ,,	12/11/09	Moist	Moist	Moist	Moist
Q. (British)	12/11/09	Dry	Dry	Dry	Dry

EXPERIMENTS WITH GREASES.

During 1908, 1909, and the present year a series of trials have been made with various greases to test their lasting power. In 1908 and 1909 the experiments were entirely with British greases. As none were really satisfactory for the proper application of this process, they were temporarily discarded, and experiments were made to find out if any of the foreign greases used for this purpose keep "tacky" over a greater length of time.

In 1909–1910 German Moth glues, or Raupenleims, and an American preparation called Tanglefoot were experimented with. Some British greases were banded alongside the German and American ones for comparison.

The results are given in Table I. on the opposite page.

The following is a summary of the results obtained with black, white and yellow greases, and a grease of the bird-lime type (Tanglefoot):—

A. *Black or Moth Glues.*—1. These seem to have too smooth a surface to hold light insects, unless put on in a very wide band.

2. Do not seem to attract insects during the day to the same extent as others.

3. Notable absence of male Winter and Early Moths on these bands.

4. Wingless females taken on a middle band of three on one tree. Females were watched crossing the bands in two instances.

5. Many insects seem to avoid these greases, but many caterpillars were caught in them.

6. Most last sticky 6 to 12 months.

B. *White and Yellow Greases.*—1. Many of these are not sufficiently sticky to hold the females unless the bands are quite 8 inches wide. Others with oils in them do so, however, at 6 inches or less, but these ran down the trees.

2. Attract insects to some extent during the day.

3. Males attracted by both yellow and white.

4. A few wingless females taken on upper bands, having crossed while still sticky.

5. Insects (males) undoubtedly caught in greater numbers by the light greases.

6. Three months seems limit of "tackiness," most 1 to 2 months.

C. *Grease of Bird Lime Type.*—1. Surface very strong holding. Bands 3 inches wide sufficient. Does not run. No harm caused by changes in weather.

2. Attracts insects during the day.

3. Attracts males to same extent or more so than white or yellow greases.

4. No wingless females or weevils taken on upper band, except in one instance (2 being found).

5. Males undoubtedly attracted by shiny nature during bright nights. The great number of males caught in some bands was remarkable.* It will be thought that this is a disadvantage, as the females could pass over their bodies. This did not appear to be so, however, the preparation soon penetrating through the wings and over their bodies, except in the Pale Brindled Beauties.

6. Lasts permanently sticky for from 8 to 9 months, and in some cases 12 months.

7. If moved over the surface becomes "tacky" again for at least another month.

Conclusion.—It thus seems that the Bird-lime type of grease is superior to A, black greases, in catching power; and to B, white and yellow greases, in lasting and catching power.

The German greases experimented with were the following: C, Noerdlingers (Floria caterpillar glue); H, Hartjens (H. Moth Glue); I, Schachts (Pixol Raupenleim); M, Wingenroths (Raupenleim); O, Ermischs (Raupenleim); P, Jungclaussens (Raupenleim).

The Width of Grease-bands.—The width of paper banding generally used is 7 in. to 10 in., and the width of the grease-band 6 in. to 9 in. Various widths were tried, and it was found that bands less than 6 in. formed an imperfect barrier in all preparations used except Tanglefoot. For the latter a 3-in. band proved sufficient for preventing the upward progress of all the insects mentioned on page 543.

For British and German greases of good quality a 7-in. band is undoubtedly wide enough, but the grease must cover most of the band. If the grease is a thin, inferior one, the band must be at least 10 in., and a good 2 in. of paper left below to catch the run of the grease.

Effect of Greases on Trees.—The effect of certain greases put on trees direct is often very bad, hence the general method has been to band the trees first with grease-proof paper. Some greases on the market contain little or no substances that are actually harmful, but if they harden into a more or less rigid band, they form an unhealthy area, and the trees do not thrive as well as they should do. If the grease should contain tar acids, the effect is often fatal. Even with a grease sent for experiment, which contained no tar acids, but which ran badly down the stem, the result was that the tree was practically killed.

With regard to the American preparation used, Dr. Howard, Chief of the Entomological Bureau of the United States Department of Agriculture, wrote me as follows:—"We

* These bands were near others 4 to 20 feet away.

have made a careful study of this material (Tanglefoot), and have failed as yet to find that it does any harm when put on the bark direct." Knowing the different effects produced by varied climatic conditions, I banded direct three young cherry trees in 1908, and two old apple trees. A thick coating of Tanglefoot was put on, rather wider than is necessary. Up to October, 1910, the young trees banded in 1908 have suffered in no way, and have no different appearance from those which were paper-banded, but it is too early yet to say if this can be done generally with young trees. With old trees it is quite a safe method, and is far more successful than paper-banding, which cannot be put on sufficiently well for the purpose on large rough-barked trees.

Papers and their Connection with Greases.—Several comparative trials were made with various British and German papers, but some of the former were not commercially sold for this purpose. The difference was very marked in one or two cases.

For instance, a black grease when put on an ordinary thin grease-proof paper dried in six weeks, while on a special insect-trap paper it lasted in a more or less sticky condition for four months. Another German grease remained only six weeks on a thin paper, and nine on a thick paper.

Two papers of especial value have come to my notice, one from Hartjen and Co., which is thick and grease-proof on each side; the other, the well-known "insect banding" of Germany manufactured by Otto Hinsberg, of Nackenheim-on-Rhine. The latter not only retains a grease in a more "tacky" condition over a longer period, but at the same time acts as a trap for Codling Maggot, Plum Maggot, Apple Blossom Weevil, and several minor pests. Its one objection is the cost, but where one has a long-lasting grease, the extra amount of insects caught by it might be worth the extra outlay. The price is, roughly, 1½*d*. a yard, with substantial reductions on large quantities.

Prices of Grease.—The prices of British greases range from 14*s*. a cwt., or £12 10*s*. a ton, to 25*s*. a cwt., or £23 a ton. Three applications of the samples at both these prices were necessary to cover the period of ascent.

In the case of the German greases, the highest was 40*s*. a cwt., or £45 a ton, and the lowest 14*s*. 6*d*. a cwt., or

£14 10*s*. Two applications of the former were necessary, but only one of the latter.

The price of Tanglefoot is 140s. a cwt., but one application only is necessary, and the width of the band one-third that of the other greases.

CONCLUSIONS.

1. To be effectual, grease-banding must be started by the beginning of October, and the bands should be kept in working order until mid-April.

2. Other injurious insects besides Winter Moths and their allies are caught in the bands.

3. The effect of most greases placed directly on the bark is injurious to young trees. Tanglefoot, however, does not seem to harm trees if placed on the trees direct, but only a series of experiments over a number of years can settle this point.

4. Of the three classes of greases experimented with, viz., (*a*) Yellow and White, (*b*) the Black German Moth Glues or Raupenleims, and (*c*) greases of Birdlime type, or Tanglefoot, it was found that the first dry too quickly, the second have a low catching power, but that the third lasts "tacky" for well over the period of attack, and by moving it with a piece of wood, is at the end of ten to even fifteen months nearly as "tacky" as before. The black greases do not seem to attract insects to the same extent as the white and yellow and shiny or birdlime preparations.

5. The process, if carried out properly, is quite successful for standards, but there is some doubt if bush trees can be so well protected.

6. The bands are best placed not less than 4 ft. from the ground, but 4½ ft. is probably safer.

7. The effect of the lasting power of the grease also depends on the quality of the paper. Thick parchment paper, grease-proof if possible on both sides, is what is required.

THE COMMERCIAL CULTIVATION OF THE LOGANBERRY.

GEOFFREY F. HOOPER.

THE Loganberry, a cross between the Raspberry and the Blackberry, was raised originally in California, and so named by the raiser, Judge Logan.

It is a fruit of much the same colour and character as the Raspberry, but is far larger and much more prolific. Many berries measure $1\frac{1}{4}$ inches in length. In flavour it is somewhat more acid than the Raspberry, but it resembles the Blackberry in that the core or plug remains in the fruit when the stalk is removed.

The fruit is admirable stewed. Its chief use, however, has been for bottling purposes, one firm of preservers alone having in the season 1909 purchased some 10 tons for this purpose only. Other manufacturers are planting large acreages to supply their own future requirements. The fruit is also largely used for jam, the preserve being very popular; it has shown a tendency, however, to become candied after keeping a time, but this can probably be rectified with experience in the boiling and preparation of the preserve.

As a dessert fruit the Logan is delicious, being sharper and more refreshing in flavour than the Raspberry, but for this purpose the berries must be allowed to become perfectly ripe on the canes. In its half-ripe and firm state it is rather acid, and for this reason, if the fruit is cultivated for dessert purposes, a market fairly close at hand is desirable. It has become especially popular in its fresh state among mining populations, where a fruit with some acidity is much appreciated.

The Loganberry has only been commercially cultivated on any large scale in this country during the past five years. Several growers now have areas of 5 acres in full bearing, and as these yield up to 4 tons of fruit per acre, an appreciable quantity is now available, and the Loganberry may be said to be fairly established in this country as one of the hardy British fruits. In some instances hop growers have utilised their hop yards for the cultivation of Logans, the poles and wires being adaptable for the purpose.

The period of fruiting of the canes is a lengthy one; the writer from his own plantations picked fruit in prime condition from the middle of July to the end of August. Pickings should be made two or three times a week, according to the weather.

Cultivation.—The canes (which should be strong and well rooted, and for preference only one year old) should be obtained from some source to be relied upon as to purity and

genuineness of stock. They must be planted, if possible, in November. (In the case of rooted "tips," the planting may be done in April.) The rows should not be more than 80 to 100 yards in length, 8 feet apart, and plants 8 feet from plant to plant; thus 650 to 700 canes or rooted tips are required per acre.

"Tips," or rootlets, are obtained by laying the tips of the canes of established stock plants in the soil and allowing them to root. When rooted, they are severed from the

LOGANBERRIES (Natural Size).

parent, and transplanted either into permanent plantations or into a bed, where they develop into canes, or "yearlings," as they are termed in the trade. No system of wiring is necessary the first year, though some experienced growers prefer to put up their wiring before planting; this, however, is not absolutely essential, as the old and young canes may both conveniently be tied to a stout stake. Where canes have been planted in the autumn, some fruit may be expected the summer following; many market growers, however, adopt the same method as with Raspberries, and cut the original canes back within a few inches of the ground shortly after planting in order to concentrate all the strength in the new growth.

Loganberry Plantation at Pershore with Tomatoes between the Rows (First Year).

Loganberry Plantation near Malvern.

The first year after planting, a crop such as potatoes, peas, beans, or tomatoes may be planted between the rows; the spaces between the Logans in the rows may also be utilised if desired. After the first year a thorough system of wiring is absolutely essential to success. The posts at each end of the row should be stout (railway sleepers do very well); they must be well tied down to blocks under the soil and well strutted. All timber used should be well creosoted or tarred. All posts should be 6 feet out of the ground, with 2 or 3 feet underground, and there should be six wires a foot apart, the first 1 foot off the ground, the sixth at the top of the post; holes should be bored through the posts *when in position,* and the wires should run free so that they may be strained with some system of strainers from one end. The posts should be 15 to 20 feet apart.

The whole work must be thoroughly and strongly done, the weight of fruit and foliage being very heavy when in full bearing, and the wind resistance very great.

The old canes should be cut out and burned immediately after the fruit is gathered, and the new canes tied up to ripen. It is advisable, if possible, to have all the canes running in one direction, preferably not facing the prevailing wind. The rows should be ploughed or dug each autumn, and hoed or horse scuffled to keep down weeds in spring and summer. As with Raspberries, plenty of manure, both stable and artificial, is desirable in order to obtain the best results.

The greatest difficulty in Logan culture arises from the mass of young wood thrown up in the spring. A number of methods have been tried; possibly the best is to drive stakes into the ground near each plant, one at each side of the wire fence, and tie the young wood up to these. It is desirable only to leave seven or eight shoots from the base; a larger number than this is unmanageable and not necessary. The young wood should be tied to the wires in the early autumn with soft twine, one cane along each wire.

The fruit should be picked before it is quite ripe, and despatched in chip baskets containing not more than 6 lb. each. Oiled paper should be put at the bottom of the basket.

The Loganberry plant lasts a long time with proper cultivation, and experience appears to show that it is not

very susceptible to spring frosts. It has, however, two foes which have recently made their appearance, and in some cases caused considerable damage and anxiety to growers, the Raspberry Beetle (*Byturus tomentosus*), and also a blotch, presumably a fungoid disease, which attacks the cane, for neither of which has an entirely satisfactory remedy been forthcoming. In conclusion, it should be said that the Loganberry is a gross feeder, and requires plenty of nourishment and attention.

Varieties of Potatoes Resistant to Wart Disease.

The most simple remedy for the prevention of Wart Disease is to avoid growing potatoes on infected land. In allotments and cottage gardens, however, it is a remedy which cannot in practice be adopted without great hardship to growers, and it is therefore a matter of the greatest importance to ascertain whether any varieties of potatoes exist which are sufficiently resistant to the disease to enable them to produce a crop of sound tubers on land containing the spores of the disease.

With this view the Board arranged for some experiments * to be carried out in 1909 by the staff of the Education Committee of the Lancashire County Council, the Harper Adams Agricultural College, Shropshire, and the Holmes Chapel College of Agriculture, Cheshire.

These experiments were made at five places, and showed that the following varieties grown on infected land were not attacked by Wart Disease:—Langworthy, What's Wanted, Golden Wonder, Sutton's Abundance, Findlay's Conquest. Snowdrop was, apparently, not always true to type, and while one form was immune another was diseased. A number of other varieties that were planted, especially those of the Up-to-Date type, were all badly diseased.

This year similar arrangements were made for trials of these varieties, and of a large number of others to be carried out. The experiment was conducted on land infected with Wart Disease, at five centres in all. At the Holmes Chapel College the land was very badly infected, and only two varieties were entirely free from the disease, viz., Sutton's Discovery and Golden Wonder, though Langworthy and What's Wanted were but very slightly attacked. Snowdrop

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* See *Journal*, December, 1909, p. 762.

and Sutton's Abundance showed a certain amount of disease, and Findlay's Conquest was badly attacked. The results at this centre showed that some varieties which usually resist the disease successfully may be attacked if the land is thoroughly impregnated with spores of the disease. At the other centres results in conformity with those of 1909 were obtained. Findlay's Conquest, Golden Wonder, and Langworthy were planted at four places; Snowdrop and Sutton's Abundance at three places; and What's Wanted at one, and in all cases they showed no trace of Wart Disease. Other varieties that were grown at from one to four places and were not attacked were:—*Early Varieties*:—Aberlady Early, Southern Queen, Southern Star; *Second Earlies*: Favourite, St. Malo Kidney, Supreme; *Maincrop*: Champion, Chiswick Favourite, Crofter, Laird, Prolific, Provost, Reading Giant, Rector, Schoolmaster, White City, Peacemaker. Millcross Early was free from disease at two centres. Snowdrop was this year planted at three centres, at two of them on duplicate plots, and was not affected, although at Holmes Chapel, where but few varieties escaped, it was attacked.

In addition to these experiments trials were made under various conditions on allotments. The Board distributed, in the spring of 1910, "seed" potatoes of the varieties known as Conquest, Langworthy, and Golden Wonder among allotment holders in several selected districts of Lancashire, Cheshire, Nottinghamshire, Leicestershire, Staffordshire, Shropshire, &c.

The results which have been reported to the Board up to the present have been satisfactory, the potatoes that have been lifted showing very little disease in any case, and none at all in most, while non-resistant varieties, such as Up-to-Date, planted in the same garden, were frequently a mass of wart and quite useless. Reports as to the cropping quality of the potatoes varied. From Alfreton, Langworthy and Golden Wonder were reported as cropping badly, while Conquest was a very good crop. At Burton-on-Trent all three varieties, though free from disease, were considered unsuitable to the soil. Excellent reports both as to yield and quality were received from Sutton Coldfield. At Huyton Quarry Golden Wonders were said to be small. At Chebsey

Golden Wonder appears to have done best, though in one case there was a "splendid crop" of Langworthys. At Norton Bridge, Golden Wonder and Langworthy have done very well, the soil appearing to suit these varieties. Conquest did not crop well. At Childer Thornton, Langworthy did best, though all varieties did well; while at Haydock, near St. Helens, all three varieties seem adapted to the soil. At Rainham, near St. Helens, Conquest was said to be a good cropper, immune to Wart Disease, and a distinct gain to the neighbourhood as a second early crop. Langworthy gave only a fair crop, while Golden Wonder was an excellent cropper, free from any kind of disease, and with one other variety was quite the best main crop potato which has been introduced into this neighbourhood. It lacked the size of the Up-to-Date, but gave a really good crop.

The Protection of Orchards from Spring Frosts.*

The prevention of damage to fruit crops from spring frosts by means of fires and smudges has been attempted by a few growers in England with some success, and in those districts of the United States where fruit is grown on an extensive scale, considerable progress has been made in recent years in investigating the value of different methods. The United States of America Department of Agriculture gives a summary of some of these methods in their Year-book for 1909,† while the results of direct investigations are given in Farmers' Bulletin No. 401. In the introduction to this Bulletin, the Chief of the Bureau of Plant Industry sums up the position at the present time as follows: "Notwithstanding the favourable results obtained it must be acknowledged that there is considerable doubt as to the possibility under varied conditions of warding off the damage from frosts by fires, and also some question as to its practicability in open orchards."

At the same time, recent experiments have proved that damage to fruit trees by frost can be controlled to a greater or less extent. Two methods have been principally adopted,

* Previous notes on this subject have appeared in the *Journal* as follows: April, 1906, p. 57; June, 1906, p. 184; Sept., 1906, p. 375; April, 1907, p. 23; Oct., 1908, p. 521; March, 1910, p. 1024.

† Pp. 357 and 390.

viz.: (1) heating the air by fires, and (2) creating a thick smoke, or "smudge," as it is called, to diminish nocturnal radiation.

Heating the Air by Fires.—When well managed, this is stated to be very effective. It is of little use when the wind is high or when the temperature falls below 20° F. Some skill is necessary in the management of the fires, the most serious mistake being to produce an intense heat by very hot fires, because this creates a strong draught which carries the heat directly into the upper atmosphere, where it is of no value. The practicability of the method is said to depend on the fact that at night there is an inversion of temperature, the air being coldest near the ground and becoming gradually warmer upwards. Hence the lower air may be warmed to a considerable extent before an upward draught is created.

The best results are obtained by means of numerous, but small, slowly-burning and well-distributed fires of coal, wood, or whatever fuel is cheapest. Crude oils have been tried and make a hot fire, but have the disadvantage of forming lampblack, which sticks to the leaves and fruit.

Oil heaters are, however, extensively used in America. One make is constructed with a centre-draught tube to feed oil to the flames, promote combustion, and make good use of the oil. It holds five quarts of oil, will burn six or seven hours, and weighs $1\frac{3}{4}$ lb. There are larger sizes, but this is large enough for all practical purposes. One hundred of these heaters are often used per acre, and can be made to raise the temperature from 10 to 15 degrees. They range in price from $7\frac{1}{2}d.$ to $1s.\ 0\frac{1}{2}d.$ each.

Considerable success has been obtained with this method, and in 1908 two men in Colorado saved large crops on the heated portion of their orchards, the remainder producing little or nothing. This was an object-lesson to growers in the State, and it is stated that in 1909 there were orchard heaters in every fruit district in Colorado. In one case a portion of an orchard was heated in the spring of 1909 during a severe frost, and a fine crop of more than 15,000 boxes of apples was secured, whereas several acres not protected by heaters did not produce a box of apples, though the trees were winter varieties ten years old and in full bearing. In another case, in New Mexico, 30 acres of orchard were heated

with about 90 oil heaters to the acre, with the result that a full crop of fruit, valued at £5,000, was obtained, while in the rest of the valley the apple crop was almost a complete failure.

Smudge Fires.—Here the object is to create a thick smoke which will lie over the orchard like a cloud. It is stated that the fires should be started early in the evening, as, if radiation is permitted to go on during the early part of the night, it cannot afterwards be checked by smoke. The method is economical and well adapted for use when the night is not windy and the temperature is not expected to fall much below 27° F. Manure with a little oil poured on it makes a good smudge fire, or mixtures of tar or oil with damp straw, hay, or sawdust. The use of moist fuel has several advantages. The water is evaporated and the vapour added to the air, the subsequent condensation of which, as it moves away from the fire, will liberate much latent heat; in addition the smoke is heavy and thick.

Oil, creosote, and other materials are also burnt in iron pots, which can be placed in suitable positions in the orchard. A full description of this method as employed in some orchards in Gloucestershire was given in this *Journal*, April, 1907, p. 23, and some preliminary experiments with the same system were conducted at Wye College in 1908 (*Journal*, March, 1910, p. 1024).

Experiments in Oregon.—Farmers' Bulletin 401 gives an account of experiments conducted in 1909 in Southern Oregon, chiefly with fires for heating the air. It is pointed out that considerable preparation is necessary in order that fires may be started immediately frost appears likely to occur. A sufficient quantity of the material to be used must be placed in position in the orchard early in the season, and everything got ready for immediate use. As regards fuel, wood was principally used in these experiments, but this would depend on local conditions. Crude oil was used to a limited extent, but the particular kind of oil which was available, being of low quality, was not successful, as it was difficult to ignite and failed to burn well. It was, however, found useful for saturating shavings and other materials for starting fires. Stable manure, straw, and rubbish were

also used to a limited extent, as well as lignite coal. The wood and coal were used to raise the temperature of the air in the orchards, but the rubbish, straw, &c., were principally employed to produce a dense smudge or smoke to protect the orchards from the direct rays of the sun in the early morning after there had been some freezing of the blossoms.

The fires were started with shavings or mill planings, sawdust, straw, crude oil, light brush, and rubbish or rakings from adjoining woods, one of the best materials being mill planings placed in medium-sized paper bags and saturated with crude oil or kerosene, these bags being prepared beforehand in considerable numbers. In some cases kerosene was poured direct on to the coarse material, but this plan was more expensive and not so effective. A kerosene torch was found useful for lighting the fires, as it did not blow out, and with this the fires for an acre could be lighted by one man in from seven to ten minutes, the number of heaps being from 40 to 50 per acre, placed between every second row of trees in each direction in the orchard. If the temperature is not very low and only needs to be raised 5 or 6 degrees, not more than 25 fires to the acre may be necessary, while 50 will be required if the temperature falls to 20° F. and needs raising by 8 or 9 degrees. In case the temperature cannot be kept up to 28° F., it is recommended that a certain amount of damp straw or stable manure should be placed on the heaps on the windward side of the orchard before the sun rises, in order to produce a dense smoke and prevent too rapid thawing of any slightly frozen fruit or blossoms.

The fires should not be so large as to produce an intense heat, and so create a sharp upward draught. Large fires are also liable to scorch the blossoms. When stable manure or rubbish was used, more heaps were placed in position, each averaging about a bushel or a bushel and a half.

The cost of the material varied greatly, but in general the cost for one night was 8*s*. to 10*s*. per acre. When stable manure and rubbish alone was used, the cost was naturally much less. Labour for firing averaged about 4*s*.

The conclusion arrived at by the United States officer,

Mr. P. J. O'Gara, who was in charge of these investigations, is that frost injury to fruit trees may be prevented by the use of fires and smudges. He found that the difference between smudged and unsmudged areas was very marked; in several instances the treated orchards set a full crop, while in those similarly situated but untreated the crop was entirely destroyed. Cases are quoted showing the results obtained by various growers at a relatively small cost.

It may be of interest to give the approximate temperatures at which, according to Mr. O'Gara's observations on the Pacific Coast, the principal orchard fruits are liable to be injured by frost. These temperatures would, however, vary somewhat according to the weather conditions preceding the frost, and they may also be only of local application.

TEMPERATURES INJURIOUS TO FRUIT WHEN IN BUD, IN BLOSSOM, &C.

	In bud. ° F.	In blossom. ° F.	Setting fruit. ° F.	At other times. ° F.
Almonds	28	30	30	28
Apples	27	29	30	25
Apricots	30	31	31	30
Cherries	29	30	30	29
Peaches	29	30	30	28
Pears	28	29	29	28
Plums	30	31	31	29
Prunes...	30	31	31	29

In considering the utility of the foregoing methods, it is obvious that the main difficulty is to know when an injurious frost is likely to occur. A careful study of local weather conditions is necessary, supplemented by a psychrometer for determining dew-point temperatures, thermometers indicating the temperature in the orchard, and a barometer to indicate the pressure of the atmosphere. The Weather Bureau of the United States issues warnings and forecasts as to the occurrence of frosts and cold-waves, and in the experiments in Oregon these were found to be of great value. They were forwarded by telegraph and telephone to the officer in charge, and as far as possible to the individual growers.

A careful study of the psychrometer, or wet and dry bulb thermometer, is essential, as from this, by the aid of suitable tables, the dew-point can be ascertained, and under certain conditions the determination of the dew-point will give

valuable information as to the probability of frost. For frost to be formed, the dew-point near the ground must be below 32° F., when the deposited water at once takes the form of ice. If the air be very dry, the temperature may fall low enough to injure vegetation without the formation of frost, *i.e.*, by what is known as a black frost. If the air be very moist, the condensation of vapour as dew may begin before the temperature of 32° F. is reached, and the latent heat liberated by the condensed water will frequently prevent the formation of frost. Hence the value of ascertaining whether the dew-point is above or below 32° F.; if above, as a general rule frost need not be feared unless the wind is still bringing colder air from neighbouring regions. The conditions favourable to frost are: (1) clear skies, with little wind movement; (2) a certain (but not excessive) amount of moisture in the air; and (3) high atmospheric pressure. The value of observing the dew-point was shown in the above experiments, in which it was found that the dew-point recorded in the evening was not far at any time from the lowest temperature recorded during the night following. A useful instrument is a thermometer which can be set to ring an electric bell at a given temperature.

Vitality of Farm Seeds.

The length of time during which seeds, especially farm seeds, retain their vitality or capacity to germinate is of considerable interest, for it is sometimes important to know the maximum age at which seeds may be expected to yield what may be regarded as a successful crop. A not uncommon view is, that it is safe to sow cereal grains two years old, while peas and beans, mangolds, cabbage, and similar seeds may be sown up to four years old. This does not mean that older seeds will not germinate at all, but that they will in general be unlikely to yield good results in practical farming. Broadly speaking, it is inadvisable to sow old seeds, and any monetary advantage which would be gained thereby would rarely be sufficient to compensate for the probable loss of germinating power. It is sound practice to sow only healthy, clean, pure, strongly-germinating seeds of the previous year's growth.

Many farm seeds, however, have been found by experiment to retain a certain percentage of germination for many years, especially when kept under conditions involving dryness and medium temperature. In a paper lately read before the Royal Society,* Miss Jean White, M.Sc., Victorian Government Research Scholar, communicates the results of an investigation into the question of the longevity of resting seeds—chiefly of cereals. Seeds of various ages were obtained from Victoria, South Australia, and New South Wales, and the germination capacity of all the specimens received was tested, from 50 to 100 seeds from each packet being sown on damp blotting paper placed in glass basins under a glass frame in a conservatory to which air had free access. The temperature was kept fairly constant at about 23° C. (73·4° F.).

Eight lots of wheat varying in age from six months to 4½ years germinated 100 per cent., while two further lots 4½ years old germinated 92 and 90 per cent. respectively. The germination of older wheats may be given as follows:—

Age.	Percentage germinated.	Age.	Percentage germinated.	Age.	Percentage germinated.
6½ years	74, 42, & 39	11½ years	12 & 0	17 years	0
7½ ,,	68, & 16	12½ ,,	4	18 ,,	0
8½ ,,	32, & 3	13½ ,,	0	19 ,,	0
9½ ,,	32, & 0	15½ ,,	0	20 ,,	0
10½ ,,	28, & 0	16½ ,,	2	21 ,,	0

In each case from 6½ to 11½ years the first figure represents a South Australian sample, and the second figure a Victorian sample, while those from 12½ to 21 years are all South Australian. The South Australian samples retained their power of germination much better than the Victorian, while the Victorian samples were superior to those from New South Wales, though not to the same extent. This appears to show that the drier the climate the longer is the life of the seed.

In regard to other cereals the results are shown in the table on the next page.

It will be seen that the barley samples began to fall off

* "The Ferments and Latent Life of Resting Seeds," Jean White, M.Sc., Victorian Government Research Scholar, *Proceedings of the Royal Society*, B. Vol. 81.

after $2\frac{1}{2}$ years, at which age a sample germinated 100 per cent., while at $4\frac{1}{2}$ years one sample germinated 72 per cent. Oats germinated 96 per cent. at $1\frac{1}{2}$ years, and 80 per cent. at $2\frac{1}{2}$ years, thereafter deteriorating until at $9\frac{1}{2}$ years none grew. Maize germinated 60 per cent. at $4\frac{1}{2}$ years old, but rye only 32 per cent. at the same age.

Seed.	Age.	Percentage germinated.	Place of origin.
Barley	$1\frac{1}{2}$ years	100	Victoria
,, ...	$2\frac{1}{2}$,,	100	,,
,, ...	$4\frac{1}{2}$,,	72	,,
,, ...	$4\frac{1}{2}$,,	54	New South Wales
,, ...	$8\frac{1}{2}$,,	18	Victoria
,, ...	$10\frac{1}{2}$,,	0	,,
Oats	$1\frac{1}{2}$,,	96	,,
,, ...	$2\frac{1}{2}$,,	80	,,
,, ...	$4\frac{1}{2}$,,	68	,,
,, ...	$5\frac{1}{2}$,,	56	,,
,, ...	$9\frac{1}{2}$,,	0	,,
Maize	6 months	100	,,
,, ...	$4\frac{1}{2}$ years	60	New South Wales
Rye	6 months	100	Victoria
,, ...	$4\frac{1}{2}$ years	32	,,
,, ...	$9\frac{1}{2}$,,	0	,,

A Milk Testing Society in France.†

The first milk record society in France was established in the district of Caux in Normandy at the end of 1908*. Such societies were first formed in Denmark, for the purpose of enabling farmers to ascertain the milk-yielding capabilities of their cows, and to improve their herds by getting rid of unprofitable animals. The records are, however, valuable to breeders, and in the case of the *Société d'élevage et de contrôle laitier du Normand-Cauchois* the functions of a Herd-book society and a milk-testing society have been combined. The object is the improvement of the Cauchois variety of the Norman breed, and the calves are registered provisionally in the herd-book at birth, the registration being confirmed in the case of females only after they have reached a prescribed standard as regards milk and butter production during a period of ten months after calving. As the number of registered cows is necessarily

* See "Milk Testing in Denmark," *Journal*, April, 1905, p. 21, and "Milk Control Societies in Germany," *Journal*, October, 1909, p. 583.

† *Bulletin de la Société Nationale d'Agriculture*, No. 6, 1910.

at first small, unregistered cows may also be submitted to the test. The action of the society is at present limited to recording the yield and quality of milk of members' cows, and does not take into account the quantity of food required by the animals as is done by the Danish and other societies. An assistant is employed by the society, who visits the farm of each member once a month. He arrives at the farm in the morning, weighs and samples the milk of each cow at the mid-day, evening, and next morning's milkings, and is taken by the farmer to the next farm to be visited. The samples are sent by post, in boxes containing 50 samples, to the Agricultural Experiment Station of the Department, and tested for butter fat, the results of the tests being sent to the Society and entered in the herd-book.

State Assistance to Agriculture in Denmark.

The Board have received through the Foreign Office a report by Mr. Vice-Consul Turner on certain points in connection with agriculture, forestry, and dairying in Denmark.

Under the Danish Budget for 1910, a sum of Kr. 5,099,630 (£283,313), or about a twentieth of the whole national annual expenditure, was allotted to the Minister of Agriculture for various objects coming within his province.

Apart from the agricultural high schools, veterinary schools, cottars' schools, experimental laboratories, and so on, which are maintained or subsidised by the State, the method whereby State assistance is rendered to the individual agriculturist may be summarised as follows:—

The individual applies to his local association (agricultural, small-holder, or so on, as the case may be) for the assistance he needs. The local association considers his application, and forwards it with remarks to the Amalgamated Association Committee of the province, who, in their turn, submit it to the Ministry of Agriculture. The Ministry replies to the local Society. By this means the administrative work of the Ministry is simplified, and, at the same time, it is possible to keep the amounts expended more evenly distributed among the various provinces.

The Danes have developed the faculty of forming them-

selves into associations to an unusual degree, the success of the co-operative movement in this country being very largely due to this cause, and in one form or another associations have been common among them from very early times. Some of the agricultural associations of Denmark have existed in their present form for over a hundred years—for instance, the Royal Danish Agricultural Society (Det Kgl. Danske Landhusholdningsselskab) was founded in 1769—while during the whole of the past century societies were founded as agricultural activity took various forms. The last twenty-five years of the century saw the growth of the co-operative dairying industry and the success attending it, and it was during this period that associations of all kinds sprang up most quickly, becoming amalgamated and developing their organisation almost automatically. The various small-holding laws at the beginning of the present century, again, have called a further number of associations into being.

In all cases it is the individuals who take the initiative and found the society, which is then recognised by the State, and eventually receives a State subvention. The subvention is almost invariably in proportion to the amount subscribed by members.

Another factor which must not be forgotten in considering any question concerning Danish agriculture is education. It is exceedingly difficult to assign the proper value to education in Danish agricultural life. In 1840, the movement, headed by Bishop Grundtvig, was commenced to educate the Danish agricultural population along more liberal lines. Peoples' high schools, agricultural schools, and so on, sprang up with great rapidity all over the country, and there are now some 126 of these which receive State aid.

In addition to the agricultural instruction received at these schools, great value is attached to their influence in educating the people to work together in co-operative undertakings, and in teaching them to appreciate the advantage of the various associations. In other words, the various schools, while being themselves the result of judiciously applied State aid, at the same time serve to produce an agricultural population who are better able to appreciate and utilise the aid given by the State in other directions.

State Aid to Agriculture.—The Royal Danish Agricultural Society, in addition to being the oldest, is also the most scientific agricultural society in Denmark. The object of the society is to encourage agriculture and agricultural industries. It is controlled by a self-elected council from a membership of about 770 persons. The Ministry of Agriculture applies to it for advice (as, for instance, in drafting new laws bearing on agricultural subjects), and has also deputed to the society some of the work connected with the Agricultural Advisers (*Landökonomiske Konsulenter*). The Royal Agricultural Society keeps in touch with the various district agricultural societies (*Amts Landboforeninger*) by means of representatives residing in the district.

The number of local agricultural societies in Denmark is 115, with a total of some 84,500 members, who pay subscriptions amounting to Kr. 196,000 (£10,900). The State subvention to these local societies for the year 1909–10 (exclusive of prizes and travelling expenses for small-holders and pig-breeders) was Kr. 193,000 (£10,730). The object of the societies (which were founded at various dates from 1810 onwards during the whole of the nineteenth century) is to promote general agricultural development by means of lectures and debates, cattle shows and exhibitions, prizes for well-kept allotments, local field experiments, the foundation of smaller associations for a special object, and so on. The State subvention above-mentioned is contributed towards defraying the expenses of Advisers (*Konsulenter*), the members of the societies being able to apply to the Adviser for advice on special subjects on the recommendation of the Provincial Association of Amalgamated Societies. In addition, the State subvention contributes towards the cost of prizes at cattle shows, lectures, and plant culture.

The subscriptions to these societies are small, as are those from the district societies to the Provincial Association of Amalgamated Societies. These last correspond direct with the Ministry of Agriculture on provincial matters, while on questions of more general importance such correspondence goes through "The Co-operating Danish Agricultural Societies" (*Samvirkende Danske Landboforeninger*). A member of a local society has an idea which he fancies might be suc-

cessfully carried out in his locality. He submits it to his society, who, if they approve of it, communicate it to the Provincial Association. This latter body considers the suggestion on its comparative merits as regards other suggestions which may have come in from other parts of the province, and, if they think fit, apply to the Ministry to send an expert to advise on the matter, and bear part of the expense connected therewith. The advantages of this method of sifting suggestions before they are submitted to the Government are obvious.

Further, by means of the lectures and discussions and cattle shows which are organised by the local societies, the farmers are kept abreast of the times, and new inventions and discoveries are brought to their notice and explained to them.

It would, perhaps, be well to emphasise the fact that Denmark is a small country, comparatively thickly populated in the rural districts, there being, with the exception of Copenhagen, no really big town. The farms also are not, as a rule, large, and communications are easy. If in addition to this we take into account the highly educated character of the agricultural population, the comparative ease with which organisations of this nature can work becomes more easy of comprehension. The natural aptitude of the Danes for forming themselves into associations and working them successfully, has been previously mentioned, and must be borne in mind.

There are various other associations which have some special branch of agriculture for their object. For example, there are some 260 horse-breeding associations, 1,310 cattle-breeding associations, 250 pig-breeding associations, 90 sheep-breeding associations, and so on, which all receive State aid, and aim at improving the stock of the district. The State subvention is paid to these associations on the recommendation of the agricultural society of the district.

The law of May 23rd, 1902, lays down the manner in which these various subventions are to be paid, and the various qualifications (membership, length of existence, &c.) which are demanded of the societies.

State Aid to Dairies.—There are some 1,500 dairies in Denmark, some 1,200 of which are co-operative, while many

of the others are run on lines resembling those of co-operation, but no direct State aid is given to the dairying industry. On the other hand, besides the State subvention to cattle-breeding associations above mentioned, there are the Control Societies which are supported by the State, which also contributes subsidies for the education of dairy-managers, and for experiments regarding cheese, cheese exhibitions, and so on.

Of these the Control Societies are by far the most important, not only in number, there being 508 receiving a total State subvention of Kr. 120,000 (£6,666), but also as regards their value as very powerful factors in the improvement of agricultural methods.

The object of these societies is, broadly speaking, to keep a record of the milk production of each cow, together with the cost and material of its keep, and thus not only to introduce careful methods into the farm, but also to improve the breed of cows by a process of selection. In this case also the State subvention is paid on the recommendation of the Amalgamated Provincial Association above-mentioned, and is also dealt with in the law of May 23rd, 1902.

State Aid to Small-holders.—The question of State aid to small-holders does not really come into consideration, being more one of economics and politics, but it may be mentioned that the Small-holders' Associations can receive State subventions for the same objects and in the same manner as the agricultural societies mentioned above, and, further, that the organisation is the same, both organisation and subvention being on a smaller scale.

Application for assistance in purchasing a small holding is made through the Parish Council to a District Commission, composed of two delegates elected by the various parishes in the district and a chairman appointed by the Minister of Agriculture. (The law of April 30th, 1909, places a sum up to Kr. 4,000,000 (£222,222) at the disposal of the Government each year for five years for the purpose of assisting peasants in making such purchase.)

State Aid to Forestry.—The Danish Heath Society (*Det Danske Hedeselskab*), founded in 1866, is the channel

through which State aid to forestry is administered in Denmark. The objects of this society are the planting of the heath lands (especially in Jutland) with trees and the reclamation of heath and marsh land. The society gives gratis advice to anyone who asks for it on these subjects, sends an expert to examine the conditions on the spot, makes the necessary plans, and supervises the work—the actual labour being done by the individual. The society further inspects and administers many of the plantations.

The State subvention to the Heath Society on the Budget for 1909–10 amounted to Kr. 546,400 (£30,355), and was expended on buying up heath land; the administration and technical departments of the society; assistance to purchasers of trees; advances under the regulations of the Ministry of Agriculture of February 26th, 1901, to purchasers of heath land which they intend to plant with trees, and which they undertake shall always remain forest land; for small plantations and hedges; assistance in the purchase and transport of marl, and for various other objects.

The administration of this money is left to the Heath Society, which renders an account of what it does to the Ministry of Agriculture. The applications for assistance are made to the society, which, among other methods of instructing its members, issues a periodical and maintains a staff of experts besides a considerable number of foresters and forest assistants.

There is further a State loan to communes in the heath district, which is accorded to them on the recommendation of the Heath Society.

General.—It will be seen that the connecting link between the Ministry, *i.e.*, the State and the individual, is always the Provincial Agricultural Association, or, in the case of forestry, the Heath Society. On questions of wider importance the State asks the advice of the Royal Agricultural Society, or the Co-operating Danish Agricultural Societies, among whose members are not only all the most prominent agriculturists in the kingdom, but also representatives from every district in the country. On questions concerning the dairy industry, the Ministry would also consult the boards

of the various provincial Amalgamated Associations of Cooperative Dairies, and those of the great export associations.

The rule is that the State receives from the Associations information as to the best means of benefiting the individual.

The Value of Crop Estimates to the Farmer.

In considering the effect which the production of the principal grain crops is likely to have on the world's markets, and hence on the price obtained for his own particular products, the farmer needs to have the information summarised in a very small compass, so that without minute and detailed knowledge, he may ascertain the probable tendency of the price of any particular crop. With a view to supplying an authoritative statement of this character, the International Agricultural Institute at Rome is endeavouring to obtain monthly reports from all the Governments of the world, and it is proposed to reduce the information thus obtained to percentage figures which will enable comparison to be made with the crops of previous years. For instance, an experimental calculation which was made in August last for a group of eleven countries showed that the probable crop of wheat was 102 per cent. as compared with that of 1909, and it is hoped in the future to publish a similar figure applicable to the whole world.

With a view to showing the value of such a "single numerical statement" of production both to producers and consumers, the Institute discusses the question in an article in its August *Bulletin*, from which some extracts may be given :—

1. *Disadvantages under which the Farmer Labours.*—The price of the staples of agriculture is mainly determined by the ratio between the world supply and the world demand, but the farmer can only guess at the price his crops will bring by basing his calculations on facts within his own limited sphere of observation.

If he sees that his own crops and those of his neighbours promise better than the previous year, he may easily come to the conclusion that the harvest in general will be abundant and that prices will fall as compared with the harvest and

prices of the previous year. Judging by local conditions, he will think himself lucky to get a moderate price, whereas, perhaps, if he had been acquainted with the general status of the supply, he could have asked and obtained a better one. Or else, seeing that the harvest prospects are poor in the district he is acquainted with, the farmer may count on obtaining a high price, and refuse to sell at a price which a wider knowledge of conditions would have shown him to be profitable and which he will regret not having accepted later on.

2. *The Farmer a Victim to Ignorance.*—The ignorance of the farmer as to the general condition of the crops of the world—as to the world's supply of the staples—places him at a great disadvantage in dealing with clever and unscrupulous manipulators.

Undoubtedly the function of the middleman, of the merchant, is in itself a most valuable one to society, for, by purchasing the staples when and where the supply is abundant, and selling them when and where the demand is high, he distributes them in accordance with the world's needs; thus scarcity and even famine is avoided, and prices are reduced, as far as possible, to a uniform level.

But the farmer's ignorance of real world conditions affords the golden opportunity for the unscrupulous speculator, who can often spread or confirm at will false rumours, artificially causing a rise or fall in prices, as may suit his own interests. The isolated and ignorant farmer falls an easy victim, and may thus lose in a few minutes a large portion of the fruits of his toil. Nor will his loss be compensated by a benefit to the consumer, for, when the time comes to sell, the manipulator, availing himself of his monopoly of knowledge, knows how to spread abroad rumours that the supply is low and extort high prices from the public.

3. *Need for the Farmer to Enlarge his Area of Knowledge.*—All this could be avoided if the farmer could have a bird's-eye view of the world's supply before selling his product. If he could stand on a high tower, and with the help of a telescope look around him, his first impressions would be corrected. The higher he stood, the more powerful his telescope, the wider the horizon brought within his sphere of vision, and the nearer his judgment would approach the truth. After

reviewing conditions in the great producing countries, he would have to draw comparisons between them, consult books and statistics for past years, and finally he would be able to summarise his observations and comparisons into a conclusion: "the condition of the growing crops of the world is, on the whole, favourable (or unfavourable) and the supply will probably be so much per cent. higher (or lower) than last year."

He will then be on a footing of equality with the merchant, and the price at which he will sell his crops will differ but little from that ultimately prevailing in the principal market centres of the world.

4. *Means of Information now at the Disposal of the Farmer.*—But it is at present an impossibility for the farmer, alone and unaided, to obtain such a knowledge of world conditions, and he must rely on the information supplied by the Press for his knowledge of the status of the supply in the principal producing countries.

It is true, indeed, that some Governments publish the figures of their own supply, but the majority do not, or else publish them too late to be of practical value, and there is at present no official summary of the world's supply which the producer can consult. Consequently, private interests step in, and, at their own expense, obtain, or attempt to obtain, this information, to be used, of course, in a large measure, to their own private advantage.

There is no lack of information from such sources, published in the daily Press, in agricultural bulletins, &c., but this information is often expressed in vague terms, its sources are unauthenticated, and it is not unfrequently contradictory. Such information is of little value to the producer, as it generally consists in broad statements, such as that the harvest in some distant country "promises well," or "prospects are poor," or "the crops have been injured by hail," or "favoured by good weather"; all statements which lend themselves to different interpretations, and which are often quickly followed by others of a contradictory or qualifying nature.

5. *The International Institute of Agriculture as a World Observatory of Crop Conditions.*—It is the purpose of the

International Institute of Agriculture to do away with this uncertainty as to the condition of the growing crops of the world and the probable world supply of the staples.

The Institute is a world observatory, established by the act of the adhering Governments, for the purpose of supplying producers and consumers with all the information obtainable on the conditions and prospects of the crops of the world.

The information supplied by the Institute is *reliable,* because it is supplied by each adhering Government, and a Government is in the most favourable position for ascertaining the truth and has no interest in misrepresenting it when once ascertained, as the Government represents the sum of the various interests existing in each country.

The information supplied by the Institute is *precise,* as it is given in percentage form. No verbal descriptions, however full, are as clear as figures. The statement that the yield of a crop in a given country is expected to be 10 per cent. higher than the previous year is understood by all, whereas the statement that in some districts rains have been beneficial to the crops, and that in others favourable weather gives hopes of an abundant yield, is vague and leads to nothing.

Up to the present, however, it has only been possible to make preliminary arrangements with this view, and some time will still have to elapse before the Institute can accomplish its purpose, which is to give the world-summary of the supply of the different staples expressed as a single numerical statement.

Divergence between Existing Estimates.—As an indication of the necessity of establishing a definite and authoritative estimate of the world's production, the Institute in its September *Bulletin* makes a comparison of the four leading estimates which have been issued this year of the world's wheat production. These estimates, if compared with similar figures for the preceding year, show a marked divergence as regards the important question whether the 1910 crop is likely to be above or below that of 1909. According to the figures of the Argentine Ministry of Agriculture, the world's production of wheat in 1910 shows a *decrease* of about $1\frac{1}{2}$ per cent., as compared with the production in 1909. The figures of the Hungarian Ministry of Agriculture, on the contrary,

show an *increase* of 2·3 per cent. over last year's production; while Broomhall and Dornbusch estimate a *decrease* of about 4·4 per cent.

There are various reasons for this disagreement, but the fact that it exists points to the need for an estimate which will be accepted as reliable by both farmers and dealers.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

MISCELLANEOUS EXPERIMENTS.

Manuring of Swedes on Hill Farms (*Somerset C.C. Agric. Instruc. Com., Rept. for period ending March* 31*st*, 1910).—An experiment with artificial manures was carried out on seven farms. The season was not a good one for swedes in the hill country, and the results were not considered sufficiently reliable for publication, but it is noted that except at one farm no crop at all was obtained without manure, and that there appears to be a lack of potash in the soil of these hill farms.

Experiments with Mangolds, Swedes, and Sugar Beet (*Coll. of Agric., Holmes Chapel, Cheshire, Year Book,* 1909).—Variety trials were carried out with mangolds and swedes in 1909. If the average yield of the whole crop is calculated as 100, the percentage yields given by the best varieties of mangolds were:—Defiance Yellow Globe, 132; New Lion Intermediate, 113; Rentpayer, 112; Large Yellow Globe, 104. The best yields among the swedes, calculated in the same way, were:—Elephant, 112; Eclipse Purple Top, 111; Invicta, 109. A diagram gives a comparison of the average yields of varieties grown during the last five years. During this time the best varieties of mangolds have been Defiance Yellow Globe, New Lion Intermediate, Rentpayer, and Windsor Yellow Globe. Among the swedes Elephant has given the best results, but there has been little difference between the other varieties.

Sugar beet was grown in 1909. Sown at the same time and treated in the same manner as the mangolds it yielded about half the weight of the average mangold crop. The roots were found rather difficult to raise when pulling, the labour and consequent expense of pulling being about two-thirds more than on a similar breadth of mangolds.

The effect of setting out at different distances apart has been tested during the past three years. The plants were set out at distances of 15 in., 12 in., and 9 in., when hoeing. With mangolds 15 in. gave the heaviest individual roots, but 12 in. gave the greatest total yield, with an intermediate size of roots. In the case of swedes, there was practically no difference in the total crop with the three distances.

Varieties of Potatoes (*Cumberland and Westmorland Farm School,*

* The summaries of agricultural experiments which have appeared in the present volume have been as follows:—Cereals, April; Cereals and Root Crops, May; Root Crops, June; Root Crops and Potatoes, July; Grass and Clover, August; Cereals, and Experiments in Ireland, September. The Board would be glad to receive for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

Newton Rigg, 13th Ann. Rept., 1908–9).—Three varieties were grown with the following results:—Monarch, 16 tons 2 cwt.; Dalmeny Beauty, 14 tons 4 cwt.; Scottish Triumph, 13 tons 12 cwt. The last-named was a few years ago the heaviest-cropping variety on the farm, but has for some years been grown from home-grown "seed," and is deteriorating. Monarch was quite new to the farm.

Experiments with Potatoes (*Coll. of Agric., Holmes Chapel, Cheshire, Year Book*, 1909).—Seventeen varieties of potatoes have been grown during the last five years. In 1909 the best, as regards total crop, were Up-to-Date, Table Talk, Factor, Dalmeny Hero, Duchess of Cornwall, and King Edward VII. A diagram is given showing the average yields of the varieties in ware, seed, and chats in the five years. The first five have been Duchess of Cornwall (Irish), Up-to-Date, Table Talk, Factor, and Highlander, but of these the first and last have given the heaviest crops of ware, the proportion of small-sized potatoes in the other varieties being rather higher.

A trial of varieties in gardens was also made, Early, Second Early, and Maincrop varieties being tested.

Manurial Trials.—During the past three years the phosphatic dressing supplied to the potato crop has been given in two forms, a non-acid manure—steamed bone flour—being tested against superphosphate applied in similar amount on adjoining land. The summarised total result somewhat favours the former on the soil of the College farm. The effect of different proportions of the ingredients in a complete dressing of artificials has also been tested. The land was all manured with 15 tons per acre of farmyard manure in the autumn. The complete mixture consisted of phosphate, 3 cwt.; sulphate of ammonia, ½ cwt.; sulphate of potash, 1 cwt. If the yield with this is reckoned as 100, the effect of reducing the quantity of one of the ingredients at a time by one-half was to reduce the crop to about 90. The effect was rather less, however, when the phosphate was reduced. Doubling each ingredient in turn produced but little effect on the yield, the heaviest crop, that with double potash, being reckoned as 105. Double nitrogen appeared to injure the quality of the tubers.

Experiments with Potatoes (*Devon Agric. Com., Rept. on Field Expt.*, 1907–9).—A manurial trial with potatoes was carried out on a light, red soil, which had not received farmyard manure for many years. With no manure the crop of marketable potatoes was 3 tons 2 cwt. per acre. A complete dressing, composed of 256 lb. sulphate of ammonia, 400 lb. superphosphate (33 per cent. soluble), and 192 lb. sulphate of potash per acre, increased this on the average to 7 tons 8 cwt., and resulted in a profit of £15 16*s.*, after allowing for the cost of the manures. A complete mixture was evidently required, as the omission of any one of the ingredients reduced the crop by about 2 tons. The substitution of 9 cwt. kainit for 192 lb. sulphate of potash in the complete dressing was equally unsuccessful, and it is considered that sulphate of potash is a far better source of potash than kainit for potatoes. The following mixture is recommended for the red soils of Devon, especially where a system of cropping without farmyard manure has tended to exhaust the land:—2½ cwt. sulphate of ammonia, 400 lb. superphosphate (33–35 per cent. soluble), 2 cwt. sulphate of potash, per acre.

A trial was made of the two new sources of nitrogen, calcium cyanamide and nitrate of lime. All the plots received 10 tons per acre of farmyard manure, and the crop of saleable tubers with this amounted to 6 tons 7 cwt.; a dressing of superphosphate and sulphate of potash in addition gave 9 tons 18 cwt., while the following were the results when four different forms of nitrogen were added to make a complete dressing:—100 lb. sulphate of ammonia, 12 tons; 100 lb. calcium cyanamide, 12 tons; 148 lb. nitrate of lime, 10 tons 7 cwt.; 120 lb. nitrate of soda, 10 tons 15 cwt. The artificial manures were applied in the drills at the time of planting.

A comparison of Scotch and Irish "seed" was made at three centres. A supply of Up-to-Date potatoes was obtained from Elgin, Scotland, and Crumlin, Ireland, and compared with Lincolnshire-grown "seed," grown in 1908 from "seed" procured from Scotland. The average crops of saleable tubers per acre were as follows:—Irish, 7 tons 17 cwt.; Scotch, 6 tons 8 cwt.; Lincolnshire, 6 tons 2 cwt.

Trials of Scotch and Irish Seed Potatoes (*Gloucestershire Educ. Com., Ann. Rept. of Agric. Sub-Com.*, 1908–9).—"Seed" of a number of varieties obtained from Ireland and Scotland was planted on two farms side by side with "seed" grown on the farm from Scotch "seed" in 1907. The season was exceedingly favourable for the potato crop, and consequently the advantage of a change of seed was not shown as in previous years.

Cultivation of Lucerne in Scotland and the Effects of Inoculation (*West of Scotland Agric. Coll., Bull. No.* 53, 1910).—The object of this experiment, which was commenced in 1904, was primarily to determine whether lucerne could be successfully grown in Scotland. The soil selected was a friable loam, well drained, and in good condition. It was found that lucerne grew quite well without a covering crop, giving a yield of 4 tons 6 cwt. per acre of green forage from seed sown at the rate of 20 lb. per acre, but where the lucerne was sown with oats only a few scattered lucerne plants remained. Lucerne is a plant requiring abundant light and air, and the competition of the vigorous roots of the oats evidently proved sufficient to kill out the young lucerne plants.

A further experiment was commenced in 1905, and continued during the succeeding four years with a view to determine the effect of a bacterial culture for leguminous crops. The field under lucerne was divided into three plots, the first being left untreated; the second was treated with the lucerne culture, the culture being mixed with a quantity of dry sand and distributed uniformly over the surface; and to the third was applied nitrate of soda at the rate of 1 cwt. per acre. This dressing of nitrate of soda was repeated in successive years, but the other two plots received no further treatment beyond a dressing of mineral manures given to all three plots in 1907 and 1909, to guard against the failure of effect, through lack of mineral constituents, of the nitrogen provided by the bacterial culture and the nitrate of soda.

The average yields per acre per annum from the three plots were 7 tons 12 cwt. from the untreated plot; 9 tons 17½ cwt. from the plot to which the culture was applied; and 9 tons 8 cwt. from the plot treated with nitrate of soda. This gave an average annual increase

of 2 tons $5\frac{1}{2}$ cwt. in the case of the second plot, and 1 ton 16 cwt. in the case of the third plot over the untreated plot, the value of these increases at 20*s.* per ton being £2 5*s.* 6*d.* and £1 16*s.* The cost of treatment per annum with the culture was 3*d.*, and that for the nitrate of soda was 10*s.* 6*d.* The profit per acre per annum from the treatment with the bacterial culture was therefore £2 5*s.* 3*d.*, and from the dressing of nitrate of soda £1 5*s.* 6*d.* With regard to the untreated plot, there was a largely increased yield in 1906 over that of 1905, and this is to be attributed to the fact that the lucerne plants were increasing their hold on the soil without any special assistance from manures. The yield remained stationary in the two succeeding years, but in 1909 there was a remarkable yield of 12 tons $10\frac{1}{2}$ cwt. per acre of green forage, which may have been due to the specially favourable season, as both the other plots also gave much heavier yields. The application in the spring of that year of the mineral manures (superphosphate and muriate of potash) may also have had a favourable influence, while another factor which may be taken into account is the natural increase of bacteria suitable to the lucerne crop. It was evident throughout the experiment that the bacteria did not spread from the inoculated plot to the other plots.

The results of the experiment showed that, although it is commonly thought that nitrogenous manures are unnecessary for a lucerne crop, nitrate of soda can be very profitably employed during the first few years of the growth of the crop. A cheaper and quite as efficacious method of promoting the growth of the lucerne is to inoculate the soil with the proper bacteria.

The experiment showed that the lucerne crop can be successfully cultivated in Scotland. The soil should be deep and rather light so as to allow the lucerne roots to penetrate freely. Soils rich in lime are preferable. The lucerne should be cut when at a height of about 12 in., and should give several cuttings in the season. The green forage may be fed to all kinds of farm stock, and is especially suitable for milking-cows. In only exceptionally favourable seasons in the west of Scotland could the crop be turned into hay.

Throughout the experiment the land had every year to be thoroughly cleaned of the grasses which grew strongly on the ground during the winter, and it is therefore recommended that the lucerne should be sown in rows in order to facilitate cleaning; otherwise the weeds would overrun and destroy the crop. If properly manured and kept clean the lucerne will occupy the ground for a considerable number of years, and when it is finally ploughed up the soil will be enriched by the highly nitrogenous root-residue, and should be able to produce a succession of good grain or other crops.

Improvement of Hill Pasture as Determined by Effect on Stock (*Aberdeen and North of Scotland Coll. of Agric., Bull. No.* 16, 1910).—These experiments, conducted at Glen Dye, in Kincardineshire, and Ardross, in Ross-shire, and extending over the five years 1905–9, were undertaken in order to ascertain a cheap method of improving poor pasture by means of various artificial manures, the improvement being determined by the increase in weight of sheep fed on the plots.

At Glen Dye the soil was a sharp gravelly one, consisting of decomposed granite, the subsoil blending into the rock. The herbage

of the plots consisted of inferior grasses and moss, with patches of rushes and ferns. Six plots of three acres each were selected, the conditions on each being similar, and the manures used were basic slag, superphosphate, kainit, and lime. The growth and decay of the plants had formed a closely matted layer of humus, two or three inches thick, which prevented the mineral manures from reaching the roots of the plants until some time after application. On such poor pasture it was essential that the cost of manurial treatment should be small, as the range of improvement would be narrow.

Plot 1 received 200 lb. of phosphoric acid per acre in the form of 10 cwt. of basic slag; plot 2 received, in addition to this dressing, 100 lb. of potash in the form of 8 cwt. of kainit; plot 3 was unmanured; plot 4 received the same dressing as plot 2, but 4 lb. of white clover seed were harrowed in; plot 5 received 10 cwt. superphosphate, containing about 200 lb. of phosphoric acid; and plot 6 was dressed with two tons of lime per acre mixed with earth. All the manures were applied in January, 1905, with the exception of that on plot 4, on which they were applied early in 1906. The sheep chosen were Black-faced wethers, and were weighed at the commencement of the grazing season and every four weeks during the season. The grazing periods were in 1905, 20 weeks, in 1906 and 1908, 16 weeks, and in 1907 and 1909, 12 weeks. In the first season the same number of sheep were grazed on each of the six plots, but the influence of the manures in the second season made it necessary to increase the stock on all but the untreated plot. The results of the experiments at Glen Dye were as follows per acre :—

Plot.	Manures.	Total live weight increase of sheep per acre during the five years.	Live weight increase over plot 3.	Value of increase at 3*d.* per lb.	Net loss after deducting cost of manures.
		lb.	lb.	*s.* *d.*	*s.* *d.*
1	Basic slag	$243\frac{2}{3}$	$91\frac{2}{3}$	22 11	7 4
2	Basic slag and kainit	$252\frac{1}{3}$	$100\frac{1}{3}$	25 $1\frac{1}{2}$	23 $1\frac{1}{2}$
3	No manure	152	—	—	—
4	Basic slag and kainit	$242\frac{1}{3}$	$90\frac{1}{3}$	22 9	27 9
5	Superphosphate	213	61	15 3	26 0
6	Lime	279	127	31 9	16 3

No system of manuring therefore resulted in the production of enough mutton to pay the cost of manures. Of the manures, 10 cwt. of basic slag (plot 1) proved most satisfactory, and as cows, calves, and sheep other than those reckoned in the experiment were put out to graze on the plots both before and after the grazing season, it will be seen that the manuring of plot 1 may perhaps be regarded as showing a profit. Superphosphate supplying the same quantity of phosphoric acid as the basic slag (plot 5) was unsuccessful, probably on account of the deficiency of lime in the soil. Kainit was not successful, as the increased yield on plot 2 over plot 1 due to the application of 8 cwt. kainit was only 10 lb. per acre in five years. The treatment on plot 6 was also unsuccessful financially, as the cost of the lime, the cartage, and the labour of mixing the compost and applying it made such treatment too expensive for poor upland pasture.

At Ardross, the second centre, five plots of rough upland pasture of four acres each were selected, the soil being light and boggy in character, with a fair amount of organic matter, but not deficient in lime. In 1905, plot 1 was manured with 10 cwt. basic slag containing 200 lb. phosphoric acid; plot 2 received, in addition to this dressing, 8 cwt. kainit containing 100 lb. potash; and plot 4 was treated with one ton of ground lime per acre. Plot 5 was seeded with white clover and cocksfoot in 1905, but the seed failed to germinate. It was, therefore, manured in 1907 with 15 cwt. per acre of low-grade basic slag containing 200 lb. phosphoric acid. Plot 3 was unmanured. The grazing periods were in 1905, 21 weeks; in 1906, 19 weeks; in 1907 and 1908, 16½ weeks; in 1909, 18 weeks. It was evident from the first that basic slag had produced an immediate effect on the pasture, so that plots 1 and 2, and in 1907 plot 5 were stocked with a larger number of sheep than the other plots. Black-faced cast ewes were used in 1905 and 1906, but in 1907 these could not be obtained, and were replaced by younger stock taken from lower ground, and unaccustomed to the conditions prevailing at the centre. In 1908 the stock were Black-faced eild ewes, and in 1909 Cheviot hoggs. From 1907 onwards the pasture had been stimulated to such an extent that it was more suitable for cattle and horses than for sheep, and a number of stirks were used with the sheep in 1908 and 1909 for various periods. The results of the experiment at Ardross were as follows :—

Plot.	Manures applied.	Total live weight increase of sheep per acre during the five years.	Live weight increase over plot 3.	Value of increase at 3*d*. per lb.	Net gain or loss after deducting cost of manures.
		lb.	lb.	*s. d.*	*s. d.*
1	Basic slag	376	142	35 6	(+) 6 7
2	Basic slag and kainit	386	152	38 0	(−) 11 6
3	No manure	234	—	—	—
4	Ground lime	229	(−) 5	—	(−) 32 3
5	Basic slag (in 1907)	313	79	19 9	(−) 12 1

Taking into account the grazing rent of the stirks, the loss on plots 4 and 5 is reduced, and the loss on plot 2 is turned into a gain of 3*s*. The basic slag paid very well, but practically no result was obtained from the kainit or from the ground lime.

The general results of the experiments at these two centres, therefore, confirmed the opinion based on the results of experiments obtained elsewhere that the most profitable manure for poor hill pasture is basic slag, especially where white clover is abundant. It must also be borne in mind that the sheep used in these experiments were accustomed to wide pasturage, and they could not be expected to thrive well on the comparatively small plots to which they were confined.

Improvement of Poor Permanent Pasture (*West of Scotland Agric. Coll., Bull. No.* 48, 1908).—The object of these experiments, which were commenced in 1901, was to ascertain how far remunerative improvement of the poor hill pastures of Scotland could be effected by the use of different manures. Only those manures were used which were likely to give good results, as it was sought to test the effects

of such manures under a considerable variety of conditions. The improvement in the pasture was measured by the increase in weight of stock (mainly sheep) fed upon five plots at each of six centres. At five centres the plots were each four acres in extent, while at the remaining centre they were only three acres. The grazing seasons for the sheep varied slightly, commencing in May and ending in October. At each of the centres one plot was left untreated, while three of the others were supplied respectively with 200 lb. phosphoric acid per acre in the form of 10 cwt. of basic slag; 10 cwt. of basic slag and 100 lb. of potash per acre in the form of 210 lb. of sulphate of potash; and 200 lb. phosphoric acid per acre in the form of 9 cwt. of superphosphate, and, in addition, 10 cwt. of ground lime per acre. The remaining plot was supplied with nitrogen by feeding the sheep with a mixture of equal parts of decorticated and undecorticated cotton cake, the cake used supplying about 50 lb. of nitrogen and 20 lb. of phosphoric acid and potash per 1,000 lb.

The soils on which the experiments were conducted were nearly all of low quality, but were not deficient in nitrogen, potash, or phosphate, and seemed to require physical improvement rather than manuring. The manuring with cotton cake and phosphate, therefore, was not very profitable. Throughout these experiments an improvement was effected by all the manures, but only in the case of basic slag was the improvement such as to make the application of manure remunerative, the increase in weight of the sheep being valued at 3*d.* per lb. Even in the case of basic slag no great and rapid improvement was effected such as took place during the well-known experiments at Cockle Park, and on the average three or four years had to elapse before sufficient return was obtained to pay for the slag. On the other hand, the effect of the slag was not exhausted after six years, the returns from the manure at the end of that time being nearly as large as ever. Potash, in the form of sulphate of potash, applied along with basic slag, though it gave a small increase in most of the experiments, did not give sufficient return to pay for its cost. Superphosphate and lime, though in all cases giving a considerable increase in mutton, did not in general give sufficient return to be remunerative, and in no case gave so good a return as the cheaper dressing of slag alone. In some of the experiments the soil was covered with a very thick, coarse sod of grass of poor quality. On such land clover plants have not room to develop, and the effect of the manure was only shown very slowly. Sheep alone are unable to eat down the grass sufficiently, and better results are obtained when both sheep and cattle are grazed on the same plots. At one centre, where the pasture was of better quality than at the others, and where there was a considerable proportion of good grasses, no satisfactory result was obtained from any treatment, and the conclusion drawn is that land of such quality requires to be improved by quite different methods.

It was noticeable at each centre that a much greater increase in the weight of the sheep was made during the early part of the summer than during the later months. Roughly speaking, the increase in the first eight weeks of the grazing season was twice as great as in the remaining twelve weeks. The influence of the weather was also

remarkable; during fine dry weather considerable increases in weight were made, while losses in weight were recorded during a wet period.

Manuring of Crimson Clover (*Devon Agric. Com., Rept. on Field Expts.,* 1907–9).—This experiment was carried out on a stiff loam, poor in available phosphate, and containing no appreciable amount of carbonate of lime. The crop was weighed immediately after cutting, and the yield on the unmanured plot was at the rate of 12 tons 13½ cwt. per acre. The heaviest crop (19 tons 5¾ cwt.) was obtained by the application of 4 cwt. superphosphate and 1 cwt. sulphate of potash per acre. Assuming that the clover is worth 15s. per ton, and deducting the cost of the manures, this mixture gave a profit of £3 14*s*. per acre.

Growth of Maize for Fodder (*Univ. Coll., Reading, Bull. vii., Results of Expts. at the Coll. Farm,* 1909).—Maize has been grown for three years, with the object of ascertaining the conditions under which it is possible to obtain a crop ready to cut as fodder for milch cows towards the middle of August. Each year's trial has been carried out on new ground, and the following dressing of manure has been applied:—10 loads farmyard manure, 3 cwt. superphosphate, 1 cwt. nitrate of soda. In 1909 the seed was drilled on May 26th, at the rate of two bushels per acre, three inches deep, in rows two feet apart. The summer of 1909 was very unfavourable, but the yield was 15 tons 2 cwt. per acre, while in the three years the average has been 19 tons 13 cwt.

Experiments on Hay in the Rick (*Jour. South-Eastern Agric. Coll., No.* 18, 1909).—The shrinkage in the weight of hay that occurs owing to the fermentation that takes place while the hay is in the rick has been investigated. When the hay was being harvested, three hop pockets containing about 50 lb. of clover hay were weighed, and then built into a rick, one each in the lower, middle, and upper parts of the rick. When the rick was cut into during the winter these pockets were taken out and again weighed, and the loss of weight due to sweating was found to be nearly 16 per cent, or about 18 lb. per cwt. A similar experiment with one sample of meadow hay in 1908 showed a loss of 17⅓ per cent.

It is pointed out that where records of experiments giving the yield of hay per acre from differently manured plots are given, no allowance is made for this shrinkage, and although such records show correctly the comparative yields from the different plots, all the yields seem slightly high, and do not show the actual yield of hay from the land available for use on the farm. Where this is required therefore it would seem that a deduction of at least 15 to 17 per cent. should be made from the figures usually given in reports on manurial trials on grass land.

Some information was also obtained as to the temperature that newly-ricked hay usually reaches. Three iron tubes, 1¼ in. in diameter, and from 9 to 10 ft. long, were driven horizontally into the rick from one to two feet above each other, the lowest being about 4½ ft. from the ground when the rick had settled. The tubes were drawn to a point at one end to allow them to be driven easily into the rick, and small holes were drilled around the pointed end so that the heat should act quickly on the thermometers. Maximum thermometers were

pushed into the tubes by thin iron rods and pulled out when the temperatures were read by strings. Two ricks were tested, one of first-cut clover hay, containing about twelve tons, and the other of second-cut clover hay, containing ten tons. The first was in ordinary good condition for stacking, and when cut into in December was found to have undergone a rather low fermentation, being only slightly browned and in good condition. The second was greener when stacked, and, as was to be expected, the thermometer readings were somewhat higher, and the hay produced showed a deeper brown colour. The report includes diagrams showing the daily temperature of each stack until fermentation had practically subsided. These show that newly-ricked hay undergoing a normal fermentation soon reaches its maximum temperature, towards the end of the first or the beginning of the second week after the hay is put into the rick. In the case of the first of these ricks the highest temperature recorded was nearly 140° F., and in the case of the second about 144° F. The rise and fall in temperature are very rapid, a rise of 25° F. occurring in stack No. 1 in twenty-four hours. Both diagrams indicate that there is also a second fermentation setting in about three weeks after the hay is ricked, and it would seem probable that it is this second fermentation that is likely to result in danger from overheating, as the hay has parted with much of its moisture during the previous fermentation, and is more likely to ignite.

Miscellaneous Manurial Experiments (*Somerset C.C., Agric. Instruc. Com. Rept. for period ending March* 31*st*, 1910).—At two farms equal money values of nitrate of lime, nitrate of soda, and sulphate of ammonia were applied as a top dressing for mangolds. The increases produced by the manures were not large, but on the average there appeared to be no great difference in value between the different forms of nitrogen.

Winter and Spring Application of Farmyard Manure (*Coll. of Agric., Holmes Chapel, Cheshire, Year Book*, 1909).—A comparison of winter and spring application of farmyard manure was made. The practice of applying farmyard manure to arable land in winter for the succeeding green crop has been questioned, owing to the possibility of loss through the manure being subjected to the washing effect of winter rains, and being in the soil so long before the plant will use it. The point has been tested during four years on land varying from medium loam to strong clay, the manure being applied in December and April in preparation for mangolds, swedes, and potatoes. The results show that each year winter manuring has given the best results. The following have been the average crops during the four years 1905–8:—

	Mangolds tons.	Swedes tons.	Potatoes tons.
Manure applied in December	22·1	14·5	5·7
,, ,, April	17·7	12·8	5·5

The difference has thus been greatest in the case of mangolds, probably owing to the advantage of having the ground in good condition for obtaining a plant, especially in unfavourable springs. In 1905 the difference in the case of mangolds in favour of winter application was very striking. In that year rain fell in heavy storms at the beginning of April, rendering the land very unsuitable for working.

while the last two weeks of April, and nearly all May were dry. In these unfavourable circumstances the land manured in the previous December showed to advantage strikingly, the crop of mangolds being 17·2 tons, while on the land manured in April it was only 9·0 tons.

Nitrate of Lime and Calcium Cyanamide (*Coll. of Agric., Holmes Chapel, Cheshire, Year Book,* 1909).—Nitrate of lime and calcium cyanamide were tried in comparison with nitrate of soda on mangolds and swedes. With the swedes calcium cyanamide gave results about equal to those of nitrate of soda, while nitrate of lime did rather better, probably owing to the good effect on that crop of the lime contained in the fertiliser. In the case of the mangolds nitrate of soda gave slightly better results than either of the new manures. Neither of these manures appears to injure the seed if applied at the time of seeding, but a small quantity of calcium cyanamide applied directly on the young mangold plants caused distinct injury.

Miscellaneous Manurial Experiments (*Rothamsted Expt. Sta., Ann. Rept.,* 1909).—The residual values of farmyard and other manures applied at different periods are being ascertained on barley in Hoos Field and on various crops in Little Hoos Field, and the weights of produce obtained from the plots in 1909 are given in this report.

Four different nitrogenous manures were compared in 1909. Superphosphate was applied to all the plots, and each of the nitrogenous manures in quantity sufficient to supply 50 lb. of nitrogen per acre. The crop was barley, and the following average yields of dressed grain were obtained, each plot being in duplicate :—No nitrogenous manure, 28·7 bush.; nitrate of soda, 48·1 bush.; sulphate of ammonia, 49·0 bush.; nitrate of lime, 46·1 bush.; calcium cyanamide, 45·2 bush.

Nitrate of Lime and Calcium Cyanamide (*Jour. Roy. Agric. Soc., Vol.* 70, 1909).—Experiments were made with four nitrogenous top dressings on wheat, barley, mangolds, and potatoes. The barley and mangolds were both exceptionally good crops, and the plots to which no top dressings were applied gave equally good results with the others, so that no conclusions as to the relative efficiency of the manures could be made. The wheat had been followed by a previous wheat crop, so that the land was not in such high condition. Here a general dressing of 3 cwt. of superphosphate and 1 cwt. of sulphate of potash per acre was given, and on four plots respectively, each in duplicate, 1 cwt. of sulphate of ammonia per acre and sufficient nitrate of soda, calcium nitrate, and calcium cyanamide to supply the same quantity of nitrogen as the sulphate of ammonia. The crops of grain, taking the average of the duplicate plots, were :—No top dressing, 12·4 bush.; sulphate of ammonia, 16·5 bush.; nitrate of soda, 19·6 bush.; calcium nitrate, 16·2 bush.; calcium cyanamide, 17·1 bush.

The potatoes were manured with 12 tons per acre of London dung, 3 cwt. superphosphate, and 1 cwt. sulphate of potash, and the same top dressings were applied as to the wheat. This crop also was good, but the nitrogenous manures exerted a small influence. The total crops, excluding diseased potatoes, were :—Standard dressing only, 13 tons 17 cwt.; sulphate of ammonia, 15 tons 2 cwt.; nitrate of soda, 14 tons 13 cwt.; calcium nitrate, 14 tons 13 cwt.; calcium cyanamide, 14 tons 11 cwt. The conclusion is drawn that there is little to choose between the four nitrogenous manures, so far as the efficacy of the

nitrogen contained in them is concerned, and the preference for one or another will depend on the price per unit of nitrogen in each.

Inoculation of Soil (*Univ. Coll., Reading, Bull. vii., Results of Expts. at the Coll. Farm,* 1909).—Plots of $\frac{1}{6}$ acre were sown with beans in 1908 and 1909 (1) uninoculated, (2) inoculated with a pure culture of nodule organisms, (3) inoculated with nitro-bacterine. In 1909 the crop was badly attacked by aphis, and the reliability of the results was thus affected. The average yields in the two years were uninoculated, 220 lb.; inoculated with pure culture, 220 lb.; inoculated with nitro-bacterine, 237 lb.

FOREIGN EXPERIMENTS.

Germination of Pollen (*Wisconsin Agric. Expt. Stn., Research Bulletin No.* 4).—An investigation by E. P. Sandsten is reported in this Bulletin into some of the conditions which influence the germination and fertility of pollen. In testing the influence of sunlight on germination, some results of interest to tomato growers were obtained. Bright sunshine was shown to be favourable to a good setting of fruit, while rainy and cloudy weather is unfavourable. Experiments in greenhouse culture with tomatoes during the winter months showed conclusively that a greater number of fruits to the cluster was set during a period of bright sunshine than during cloudy weather. The development of the anthers was also greatly retarded by cloudy weather. In the case of apples and plums, sunshine appeared to have little or no effect.

The effect of low temperatures on pollen was tested as bearing on the question whether a light frost is likely to kill the pollen and thus prevent fruit from setting. Temperatures a little below freezing-point were not seriously injurious to the pollen of apple, pear, and plum. In the case of cherry and peach about one-half of the pollen failed to germinate after exposure. The pistils of the apple, pear, peach, plum, and cherry proved more susceptible to the low temperature than pollen, so that a heavy frost will kill the pistil while it may not injure the ripe pollen to any degree. In this connection it is mentioned that it is often thought that the juice of the stigma becomes diluted and washed off during heavy and prolonged rains; observations appear to show, however, that the stigma is not seriously injured by rain, though prolonged rain prevents the proper dispersion of pollen during the period of receptivity of the stigma, which lasts only for a few days.

To determine the possible influence of cultivation and manuring upon the production and fertility of pollen, apple pollen was gathered from a neglected orchard, which, according to the owner, had not been sprayed, cultivated, or manured since it was planted nineteen years ago. The trees showed abundant evidence of neglect. Pollen was taken from six different trees and also from six trees in a highly cultivated orchard close by. The differences in the percentage of germination from pollen in the neglected orchard as compared with those of the cultivated orchard were not strikingly great, though great enough to demonstrate the fact that this, in common with other parts of the tree, was suffering from lack of cultivation. There was enough pollen in the neglected orchard to pollinate all the flowers therein, provided the weather was favourable, but, on the other hand, the size of the pollen was plainly inferior. The pollen grains lacked plumpness, regularity, and size as

compared with the pollen from the other orchard, and the length of time they took to germinate indicated a lower state of vitality. Close observation also revealed the fact that the flowers in the neglected orchard were much smaller and the stamens and pistils dwarfed and deformed in many cases. The question of the longevity of pollen is an important one to the plant breeder, and it was shown that if kept in a dry place in a temperature ranging from 50 to 65° F. apple pollen can be kept for six months or longer; the limit for plum pollen was less, but generally it would seem that pollen can be safely transported and kept for some time without any very noticeable effect on its vitality.

Under favourable conditions it was found to take from 9 to 32 hours for the pollen tube of apples, plums, and cherries to reach the ovary when placed on the stigma or in the germinating medium. Cherry pollen requires a little over 12 hours. Under natural conditions the time would be somewhat greater, but two or three bright, warm days at the time of full bloom is sufficient for the setting of the fruit. These figures show that the danger period from frost is comparatively short, and this accounts for the fact that often a frost during full bloom apparently does very little damage, while at other times a similar frost may completely kill the essential parts of the flower.

Cross- and Self-Pollination of the Apple (*Oregon Agric. Coll. Expt. Stat., Dept. of Horticulture, Bull.* 104).—This bulletin contains the results of an inquiry into the value of cross-fertilisation in apples. Many varieties cannot be fertilised with their own pollen, but only with that from another variety. It is important, therefore, that apple-growers should not plant large areas of self-sterile varieties, but mix them with other varieties in order that the opportunities for pollination may be increased. It was found in the course of this inquiry that out of 87 varieties of apples 59 were found to be self-sterile, that is, unable to set fruit when self-pollinated, 15 varieties were self-fertile, while 13 varieties were classed as partially self-fertile. The sterility or fertility of a variety has, however, been found to be greatly influenced by climatic conditions, and consequently conclusions arrived at in one locality as to the behaviour of any variety may not hold good in other localities. The fact that such a large proportion of varieties were found to depend entirely upon cross-pollination is evidence of the practical importance of the question, and, in addition, it was found that even in the case of those that are well able to produce fruit when fertilised by their own pollen, better results were obtained from cross-pollination.

The Yellow Newtown, an apple that will set fruit without the aid of cross-pollination, was crossed with a number of varieties, and in every case much larger and finer apples were obtained than by self-fertilisation. Out of forty apples produced by self-fertilisation, thirty were inferior in size when compared with the apples produced by cross-fertilisation. In the orchards of the district a large number of small malformed apples were found, which were similar to those obtained by self-fertilisation of Yellow Newtown, and which could not be attributed to aphis attacks.

Considerable variation appears to exist in effect of cross-pollination. All varieties do not cross satisfactorily with each other, while when

one variety was fertilised with pollen from a number of others distinct differences were found in the number of fruits set from the different crosses and in the average weight of the produce. The suitability of varieties for crossing is a matter for investigation, but it is pointed out that in planting varieties together their pollen-producing qualities should be taken into consideration, as well as their commercial value, while it is important that they should come into blossom at about the same time, or at any rate that their blossoming periods should overlap.

In the course of these investigations some experiments were made to ascertain the part played by the wind and by bees in pollenising fruit trees. Small glass slides 1×3 in. in size, smeared with vaseline, were placed at distances varying from 4 to 30 ft. from large trees in an orchard, and at heights from the ground level to 9 ft. After an exposure of twenty-four hours the number of pollen grains found on each slide varied from 7 to 16. The trees were in the height of their blooming period, and a strong wind was blowing, so that it is concluded that the wind cannot be relied upon to transfer pollen from tree to tree. To confirm the point the blossoms of a tree were emasculated and the petals, by which bees are attracted, were removed. During the whole period that the pistils of these blossoms remained receptive only eight bees were seen to visit the tree, while more than twice that number were seen in half an hour on a tree that blossomed profusely 20 ft. away. Out of 1,500 blossoms emasculated only five set fruit, from which it is concluded that fertilisation is almost entirely dependent on bees and other insects.

Many of the varieties experimented with are not much known in this country, but among those found to be self-sterile, that is, needing cross-pollination, were Bottle Greening, Canada Reinette, Gravenstein, Holland Pippin, Jonathan, King of Tompkins Co., Monmouth Pippin, Rhode Island Greening, Summer Pearmain, Twenty Ounce, Winesap, and York Imperial.

Among self-fertile varieties were Baldwin, Keswick Codlin, Duchess of Oldenburg, White Pippin, and Yellow Newtown, and among partially self-fertile varieties were Ben Davis and Canada Red.

MISCELLANEOUS NOTES.

Importation and other Regulations.

Exportation of Horses from Great Britain.—The Board of Agriculture and Fisheries desire to call the attention of persons concerned in the exportation of horses, asses, or mules from Great Britain, and of the public generally, to the provisions of the Diseases of Animals Act, 1910, which came into operation on October 1st, 1910. The Act provides, *inter alia,* for the examination immediately before shipment by a Veterinary Inspector appointed by the Board, at the owner's expense, of all horses, asses, or mules shipped from Great Britain to any port outside the British Islands. An exception is made in the case of the shipment of any thoroughbred horse certified by the Jockey Club to be travelling for certain purposes, and in such cases as may be prescribed by Order of the Board.

In the Exportation of Horses Order of 1910 (No. 2), the Board have provided for the exemption from such veterinary examination of (*a*) any horse, ass, or mule shipped to any port which is not in Europe, and (*b*) any horse, ass, or mule intended for breeding, racing, or exhibition, or as to which the Board are satisfied, regard being had to its value and the purpose for which it is exported, that a veterinary examination is unnecessary. A permit from the Board will, however, be required in respect of every exempted horse, ass, or mule referred to in (*b*) above, before its shipment can take place. The Order also provides for the payment of a fee of 2*s*. 6*d*. for each animal examined by a veterinary inspector.

The Order above referred to revokes the existing Exportation of Horses Order of 1910, under which the examination of decrepit horses exported to Belgium or the Netherlands is made by a Veterinary Inspector of the Local Authority of the port from which such animals are shipped.

Footh-and-Mouth Disease in Yorkshire.—All the general restrictions which were imposed by the Board on the movement of animals in connection with the outbreaks of foot-and-mouth disease in Yorkshire were withdrawn on August 29th last.

Importation of Cattle into Australia.—The Board of Agriculture and Fisheries have been informed by the High Commissioner of the Commonwealth of Australia that the prohibition against the importation into that country from Great Britain of cattle, sheep, goats, and pigs which was rendered necessary by reason of the outbreak of foot-and-mouth disease in Yorkshire in July last, has been removed.

Demand for Agricultural Machinery Abroad.

Agricultural Machinery in India.—An account is given in the *Indian Trade Journal* of July 28th, 1910, of the use of agricultural machinery in the Central Provinces of India. In the cotton belt there is a demand for iron ploughs, which should be strong, simple in construction, and at least 10 stones in weight, and spare parts of such ploughs should always be available and easily adjustable. The ploughs supplied by the Central Provinces Department of Agriculture cost 40 rupees. Openings also exist for hand-gins, fodder cutters, reaping machines, winnowers, and other implements. To meet the requirements of the average cultivator, the initial cost of all implements and machines should be as low as possible, and the article should be capable of being easily and cheaply repaired; the implement must not be complicated or easily broken. Any firm wishing to stimulate the sale of agricultural machinery in the Central Provinces should, after consulting the local administration, establish an implement depôt in the district in which the demand exists for the article to be supplied. A supply of spare parts should be kept in stock, and provision made for the execution of repairs.

Further information as to the Central Provinces appeared in the *Indian Trade Journal* of August 25th.

Agricultural Machinery in Poland.—A report on the trade of Poland, which is about to be issued as a Foreign Office Report, states that the year 1909, as regards crops, was a very favourable one for

the Polish farmer; corn was high in price, and the demand for agricultural machinery for this reason was brisk. Nearly every variety of machinery was sold in larger quantities than during the preceding year, with the exception of harvesting machinery, of which less was sold, owing to most adverse weather during the very retarded reaping season, which made the use of such machinery impossible. The demand for mowing machinery was also less, persistent drought during the spring having greatly impaired the grasses. Owing to the passing of land into the hands of the peasants and the division of estates and farms, which is growing more and more frequent, the demand for smaller implements, which it would not pay to import from abroad, is steadily increasing, and the home manufacturers producing such implements are prospering.

Notes on Agriculture Abroad.

Bacon Curing in Sweden.—H.M. Vice-Consul at Malmö reports (*Foreign Office Report, Annual Series, No.* 4527) that agriculturists of the district contemplate forming a co-operative association with the object of erecting a central slaughterhouse at Malmö for the purpose of of curing bacon for the British market. Calculations are based upon a yearly output of between 30,000 and 50,000 pigs. At Tomelilla, a place situated about forty miles east of Malmö, a similar association has been working during 1908 with satisfactory results.

Consumption of Fertilisers in Germany.—The enormous increase in the use of fertilisers in Germany during the last decade is shown in the following table, taken from the *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft,* May 26th, 1910. The expenditure on fertilisers is stated to amount at the present time to about 4*s.* 6*d.* per acre.

	1900. Cwt.	1905. Cwt.	1909. Cwt.
Bone meal	1,249,000	1,298,000	1,770,000
Guano (artificial and natural) ...	737,000	1,407,000	892,000
Superphosphate and compound manures	14,856,000	19,556,000	23,841,000
Basic slag	17,296,000	22,195,000	23,975,000
Nitrate of soda	6,942,000	7,781,000	9,408,000
Sulphate of ammonia	2,315,000	4,042,000	5,892,000
Potash salts	16,402,000	28,269,000	39,832,000
Various fertilisers	984,000	984,000	984,000
Total ...	60,781,000	85,532,000	106,594,000

The figures given above represent, so far as can be ascertained, the quantity actually entering into consumption. The total estimated value in 1909 was £18,625,000.

Area under Crops and Live Stock in Great Britain.

The following preliminary statement, compiled from the Returns collected on June 4th, 1910, shows the area under crops and number of live stock in Great Britain at that date.

DISTRIBUTION.	1910.	1909.	INCREASE.		DECREASE.	
	Acres.	*Acres.*	*Acres.*	*Per Cent.*	*Acres.*	*Per Cent.*
TOTAL AREA (excluding WATER)	**56,214,153**	56,214,153	—	—	—	—
TOTAL ACREAGE under all CROPS and GRASS (*a*)	**32,144,095**	32,183,073	—	—	38,978	*0·1*
ARABLE LAND	**14,667,224**	14,730,668	—	—	63,444	*0·4*
PERMANENT GRASS (*a*) For Hay	**5,004,914**	4,777,388	227,526	*4·8*	—	—
PERMANENT GRASS (*a*) Not for Hay...	**12,471,957**	12,675,017	—	—	203,060	*1·6*
PERMANENT GRASS (*a*) TOTAL...	**17,476,871**	17,452,405	24,466	*0·1*	—	—
Wheat	**1,808,821**	1,823,498	—	—	14,677	*0·8*
Barley	**1,728,690**	1,664,386	64,304	*3·9*	—	—
Oats	**3,020,618**	2,981,877	38,741	*1·3*	—	—
Rye	**48,255**	55,566	—	—	7,311	*13·2*
Beans	**270,036**	313,864	—	—	43,828	*14·0*
Peas	**168,728**	183,910	—	—	15,182	*8·3*
Buckwheat	**4,997**	4,759	238	*5·0*	—	—
Potatoes	**539,684**	575,461	—	—	35,777	*6·2*
Turnips and Swedes	**1,565,166**	1,555,548	9,618	*0·6*	—	—
Mangold	**442,779**	456,490	—	—	13,711	*3·0*
Cabbage	**61,929**	66,854	—	—	4,925	*7·4*
Kohl-Rabi	**14,880**	17,734	—	—	2,854	*16·1*
Rape	**81,556**	87,443	—	—	5,887	*6·7*
Vetches or Tares	**104,546**	136,245	—	—	31,699	*23·3*
Lucerne	**58,505**	65,327	—	—	6,822	*10·4*
Carrots	**10,722**	11,226	—	—	504	*4·5*
Onions...	**4,038**	3,823	215	*5·6*	—	—
Flax	**229**	295	—	—	66	*22·4*
Hops	**32,886**	32,539	347	*1·1*	—	—
Small Fruit	**84,299**	87,116	—	—	2,817	*3·2*
CLOVER and ROTATION GRASSES ... ... For Hay	**2,074,206**	2,035,773	38,433	*1·9*	—	—
CLOVER and ROTATION GRASSES ... ... Not for Hay...	**2,082,211**	2,178,802	—	—	96,591	*4·4*
CLOVER and ROTATION GRASSES ... ... TOTAL...	**4,156,417**	4,214,575	—	—	58,158	*1·4*
OTHER CROPS	**105,567**	102,991	2,576	*2·5*	—	—
BARE FALLOW	**353,876**	289,141	64,735	*22·4*	—	—
ORCHARDS (*b*)	**250,653**	251,336	—	—	683	*0·3*

LIVE STOCK.

	No.	*No.*	*No.*	*Per Cent.*	*No.*	*Per Cent.*
Horses used for Agricultural purposes (*c*)	**1,136,841**	1,132,014	4,827	*0·4*	—	—
Unbroken horses:—One year and above ...	**282,269**	294,657	—	—	12,388	*4·2*
,, ,, Under one year	**126,177**	126,322	—	—	145	*0·1*
TOTAL OF HORSES	**1,545,287**	1,552,993	—	—	7,706	*0·5*
Cows and Heifers In Milk...	**2,225,098**	2,232,218	—	—	7,120	*0·3*
Cows and Heifers In Calf, but not in Milk	**542,508**	561,958	—	—	19,450	*3·5*
Other Cattle :—Two years & above	**1,353,180**	1,317,215	35,965	*2·7*	—	—
,, ,, One year & under two	**1,519,562**	1,473,918	45,644	*3·1*	—	—
,, ,, Under one year ...	**1,396,950**	1,435,673	—	—	38,723	*2·7*
TOTAL OF CATTLE	**7,037,298**	7,020,982	16,316	*0·2*	—	—
Ewes kept for breeding	**10,664,964**	10,810,476	—	—	145,512	*1·3*
Other Sheep :—One year & above	**5,486,982**	5,860,907	—	—	373,925	*6·4*
,, ,, Under one year ...	**10,949,194**	10,947,036	2,158	*0·0*	—	—
TOTAL OF SHEEP	**27,101,140**	27,618,419	—	—	517,279	*1·9*
Sows kept for Breeding	**331,473**	316,552	14,921	*4·7*	—	—
Other Pigs	**2,018,424**	2,064,335	—	—	45,911	*2·2*
TOTAL OF PIGS...	**2,349,897**	2,380,887	—	—	30,990	*1·3*

(*a*) Excluding Mountain and Heath Land used for grazing (12,844,226 acres in 1910).
(*b*) Any Crop or Grass grown in Orchards is also returned under its proper heading.
(*c*) Including Mares kept for Breeding.

Report on Agricultural Conditions on October 1st.

The Crop Reporters of the Board, in reporting on the state of the crops and the agricultural conditions on October 1st, generally refer to the very fine weather which prevailed during the past month, enabling the corn harvest, which had been greatly hampered by adverse conditions at the end of August, to be rapidly completed under very favourable circumstances. In the south and east the crops had very generally been secured by the third week of September, and even in the south of Scotland comparatively little was outstanding by the end of the month. Generally speaking, all three cereals were got in at about the same time, there being a difference of very few days only as between wheat, barley, and oats.

Potato disease, which was noticed as being prevalent last month, is now reported to be both more widely distributed and more intense. As before, it is worse in the south-east, but the north and west, where comparatively little had appeared a month ago, have now considerable areas affected, and mention is made of attacks in certain counties in Scotland. Potato-lifting was generally in progress, in England, by the end of the month. The crop is much better in the north than in the south; and, upon balance, the prospect for the whole country is for a yield per acre just about equal to the average of the past ten years.

Turnips and swedes have not fully maintained their promise of a month ago; a good many reporters speak of improvement, but most mention a want of rain. There is not very much variation in the prospects of these roots as between different parts of the country. Mangolds have declined very slightly, but their prospects are not materially different from those on September 1st. Representing a ten-years' average by 100, the appearance of the roots on October 1st indicates yields per acre for Great Britain which may be represented by the following percentages:—Turnips and swedes, 104; mangolds, 103.

The prolonged fine weather allowed farmers to proceed with autumn cultivation without delay, and good progress had, in the south, been made by the end of the month. In the east considerable areas had already been sown with wheat, and elsewhere a beginning had in many cases been made. In many places, however, throughout England and Scotland, complaints were frequent that the land was too hard for working. In the north and Wales little or nothing had been done towards autumn cultivation.

"Seeds" are generally a full and vigorous plant and look well, with the exception of a few districts, where they are reported to be "patchy."

Pastures may on the whole be regarded as affording plenty of keep, but the prolonged absence of rain was affecting them; in some districts, more especially in the north and west, they were going off. Live stock are practically everywhere reported to have done well, owing to the more congenial weather of the month.

The supply of labour is reported to have been sufficient for all requirements.

Notes on the Weather in September.

During the *first* week, August 28th to September 3rd, the weather continued rainy and unsettled at first, but subsequently improved in England, and for a time in Scotland also. Rainfall was "heavy" except in England E. and S.E., where it was "moderate." Warmth was "moderate" everywhere, and sunshine either "moderate" or scanty.

In the *second* week the conditions were fair and dry. Rainfall was "very light" in England S.E. and S.W., and "light" in all other districts. Warmth was "moderate" in Scotland N. and W., and elsewhere "deficient," but sunshine varied considerably, being "scanty" or "very scanty" in all the eastern districts of England and the Midlands, "moderate" in Scotland E., and elsewhere "abundant."

The weather continued fair and dry during the *third* week. There was a heavy fall of rain in the eastern counties of England, but over the rest of the country little rain fell. Temperature remained below the average, as well as bright sunshine except in Scotland N. and W.

In the *fourth* week similar conditions prevailed generally. In every district little or no rainfall occurred. Temperature was below the average, being classed as "deficient" over the whole of England and "moderate" in Scotland. Sunshine, however, was tending to a general excess over the normal, and was "abundant" in England S.E. and S.W., and in Scotland E.

The weather during the *fifth* week was much less settled than in the previous week, though the rainfall was everywhere "moderate," or "light," and in Scotland N. "very light." The warmth recorded was everywhere above the average, and in England N.E. was classed as "very unusual."

Notes on Crop Prospects Abroad.

The following information has been published by the International Institute of Agriculture, Rome, in the Bulletin of Agricultural Statistics for September (No. 9) and shows the average condition of the crops on or about September 1st.

(100=AVERAGE CONDITION.)

Country.	Wheat. Winter.	Wheat. Spring.	Barley.	Oats.	Maize.
Austria *[1]	2·8	—	2·9	2·7	2·2
Canada [2]	—	—	—	—	84·82
Germany *[1]	2·5	2·7	2·7	2·7	—
Great Britain	99	—	100	98	—
Sweden	109	—	108	108	—
United States	—	80·9	85	104·8	98·4

* 15th August. [1] Scale: 1=very good; 2=good; 3=average; 4=poor; 5=very poor. [2] Percentage of a standard condition.

The following supplementary notes are given:—

Germany.—During August the weather was not everywhere favourable for harvest operations. Numerous complaints have been

received as to the highly injurious effects of excessive moisture upon the cereals, of which the quality has, in consequence, depreciated. Barley and oats are the principal crops having suffered from the rain. The present outlook shows a decrease on last month's estimate. Winter rye, among other crops, will yield a much smaller harvest than in 1909, and the yield of winter wheat and of barley will also be inferior to last year's yield. However, in general, the result of the rains will be to repair the damage caused by the heat in June. The probable production of the different cereal crops, in percentages of a "normal" harvest, is as follows:—Winter wheat, 91·3; spring wheat, 88·7; winter rye, 91·8; spring rye, 85·7; barley, 87·8; oats, 90·6.

Denmark.—The ungenial weather during August, and the heavy rainfall—which reached a height of 3·937 in., as compared with an average for the past thirty-two years of 3·1496 in.—has unfavourably affected the quality of the grain which had already been harvested. Rye and white oats have especially suffered.

Canada.—The drought which prevailed in the Prairie Provinces during July has reduced the harvest area for wheat 22 per cent., oats 24 per cent., and barley 34·5 per cent. Serious damage has been caused by root maggots, and locusts are reported locally.

Italy.—Wheat.—The result of the final harvest estimates, at present being made, will be very inferior to the estimate made in June.

Maize.—In northern Italy, a yield inferior to that of last year is anticipated in the mountain districts, but in the plains a larger yield than in 1909 is expected. In central and southern Italy maize has suffered from drought. The total production for the whole of Italy is estimated as being slightly above that for last year.

Luxemburg.—Weather was very unfavourable during August. The wheat and rye harvests have been completed under favourable conditions; the harvesting of oats has been delayed, and this crop has been damaged by mice and weeds.

Roumania.—As a result of the drought which prevailed during August, the favourable condition of maize, which last month promised one of the most abundant harvests the country has yielded, has considerably deteriorated. Late sown maize has suffered principally in the plains, and the production will fall far short of the estimate made before the drought set in.

New Zealand.—Area sown, 1910–11:—Wheat, 410,000 acres; barley, 82,000 acres; oats, 363,000 acres. Condition of the crops: 100 for wheat, barley, and oats.

Austria.—A report of the Austrian Ministry of Agriculture referring to the middle of September gives the condition of the crops as follows:—Wheat, 2·8; rye, 2·4; barley, 3·0; oats, 3·2; maize, 2·2; sugar beet, 2·5 (1=very good; 2=above average; 3=average; 4=below average; 5=very poor). There was a general improvement in the weather during the last half of August, but this was followed by less favourable conditions during the first half of September, and the oat and barley crops which were being harvested in the Alpine districts suffered in consequence. In the higher Alpine districts the oats were being cut, though the crop was not yet ripe. The sowing of winter wheat and rye in the Carpathian districts was progressing favourably

owing to the moist condition of the soil, and was partly completed, but in the Alpine districts it has been delayed by the late harvest.

Roumania.—The *Curier Financiar* (Bucharest) of August 28th announces that the Roumanian "Service de la Statistique du Ministère des Domaines" has published the following particulars regarding the approximate total results of the Roumanian harvests for 1910:—Wheat, 103,100,100 bush.; rye, 7,980,000 bush.; barley, 28,900,000 bush.; oats, 27,800,000 bush.; and colza, 3,850,000 bush. (*Board of Trade Journal,* September 8th, 1910.)

Bulgaria.—H.M. Minister at Sofia reports that an exceptionally large grain crop is anticipated in the department of Varna; and, though crops have been partially destroyed in some districts owing to floods and hailstorms, the outlook in the country on the whole is decidedly more favourable than usual. It is expected that the yield will be 35 per cent. higher this year than last. (*Board of Trade Journal*, September 1st, 1910.)

Italy.—Wheat Crop Prospects.—H.M. Consul at Naples (Mr. S. J. A. Churchill, M.V.O.) has forwarded an extract from a local newspaper giving a statement issued by the Ministry of Agriculture relative to the condition of the Italian wheat crop, concerning which grave anxiety has been felt.

In Piedmont, Lombardy, and Venetia, though the adverse conditions have not been without effect on the crops, the forecasts already issued do not need any serious modification. In the province of Rovigo, where the crop has been estimated at 23 per cent. less than last year, the result is likely to be somewhat better than the estimate. As regards Emilia, the forecast of a poor crop in Ferrara is confirmed, and the results of the threshing in various other provinces show the production to be much inferior to the estimate. The hopes that were entertained of a harvest in Tuscany greater by 22 per cent. than that of last year have been falsified. In Umbria and in Latium also, where a production about equal to that of 1909 was forecasted, a diminution now appears. In the Marches, in Abruzzi e Molise and in Apulia, where the crop was forecasted to be 24, 26, and 34 per cent. respectively less than in the previous year, it will be 50 per cent. less. In Campania, Basilicata, and Calabria the harvest results will be inferior to those expected. In Sicily the results will in many parts be much inferior to those forecasted. In Sardinia, however, the estimates already made still hold.

In general, the wheat crop of Italy will be notably less than was anticipated in the first official estimate of 50,000,000 quintals. (*Board of Trade Journal,* September 1st, 1910.)

Hungary.—The Ministry of Agriculture estimates the yield of the crops on September 9th as follows:—Wheat, 23,092,000 qrs.; rye, 6,659,000 qrs.; barley, 7,630,000 qrs.; oats, 8,132,000 qrs. Maize was estimated on September 25th at 22,264,000 qrs.

Argentina.—A dispatch from H.M. Consul at Rosario, dated August 29th, states that no rainfall has been experienced in the district since April, and the prospects of the next season's crops of wheat and linseed are so unfavourable that unless there was abundant rain within a fortnight after the date of the report the linseed crop would be lost. The wheat crop is expected to be considerably below the average.

It is stated that there is a deficiency in the supply of fodder for animals, which are consequently in a bad condition.

According to a dispatch from H.M. Consul at Buenos Aires, dated September 1st, it was then too early to estimate what were the prospects of the next harvest, but the linseed crop in the provinces of Sante Fé and Cordoba is said to have been destroyed owing to the continued drought in those provinces, and though more than usual has been planted in the province of Buenos Aires it is not known whether this will compensate for the loss in the other provinces, as the crop, owing to its having been planted late, may not be sufficiently advanced to escape destruction by locusts.

According to *The Review of the River Plate* of September 16th, there has been a complete break up of drought all over the country, and the rains are said to have done much good to the crops.

Canada.—The Bulletin issued by the Canadian Census and Statistics Office in September states that the condition of the crops improved during August, and in the older provinces the grains had matured well and had been harvested in fine condition. The estimated production of the various crops is as follows, compared with the final estimate for 1909:—

	1910. Bushels.	1909. Bushels.
Wheat	122,785,000	166,744,000
Oats	283,247,000	353,466,000
Barley	39,388,000	55,398,000

Fruit Crop of Canada.—The fruit crop of Canada is expected to be a poor one. In British Columbia only is the outlook favourable, and the indications in that province point to a record crop. The apple crop of Ontario and eastern Quebec promises to be poor, and the fruit crop of Nova Scotia is stated to be a failure. (*Canadian Horticulturist,* September.)

Natal Maize Crop.—The Imperial Trade Correspondent at Durban (Mr. A. D. C. Agnew) reports, under date August 26th, that the final estimate of this season's maize crop in Natal, made by the *Agricultural Journal,* is 132,000,000 lb., as compared with 160,000,000 lb. in 1909. The consumption in Natal is about 70,000,000 lb., leaving 62,000,000 lb. available for export, as against 90,000,000 lb. last year. The average yield per acre this year is 800 lb., while in 1909 it was 972 lb. (*Board of Trade Journal,* September 22nd.)

France.—The estimate of the French Ministry of Agriculture given in the *Journal Officiel* of September 23rd, places the yield of wheat at 260,070,000 bushels, as compared with 345,185,000 bushels in 1909. The area under this crop is stated to be 16,114,000 acres, as compared with 16,293,000 acres in 1909. The production of rye and mixed corn is given as 46,722,000 bushels and 5,545,000 bushels respectively, as compared with 53,236,000 bushels and 6,813,000 bushels in 1909; and the area under these two crops as 3,060,000 acres and 341,000 acres, compared with 3,031,000 acres, and 350,000 acres in 1909.

Russia.—According to a dispatch dated September 23rd received from H. M. Consul at St. Petersburg, the total yield of grain crops in Russia is now estimated at considerably below the amount at first anticipated. The Central Statistical Committee gives, in an estimate

based on July reports, the yield of the various crops for 1910 for 63 Governments as follows, compared with the yield in 1909:—

	1910. Qrs.	1909. Qrs.
Wheat	85,400,000	89,600,000
Rye...	100,800,000	101,733,000
Barley ..	52,080,000	56,000,000
Oats...	93,330,000	112,000,000

The *Commercial Gazette* of Russia, however, in an estimate based on September reports, gives the yields in 1910 for 63 Governments as follows:—Wheat, 69,530,000 qrs.; rye, 89,600,000 qrs.; barley, 42,000,000 qrs.; oats, 88,300,000 qrs.

(*The quarter of wheat and rye has been taken as* 480 *lb., of barley as* 400 *lb., and of oats as* 312 *lb.*)

United States.—According to the Crop Reporting Board of the Bureau of Statistics of the United States Department of Agriculture the condition of the crops on October 1st was as follows:—Spring wheat, 94·1; barley, 88·1; maize, 80·3. The estimates of the yield of the various crops compared with the final estimates in 1909 are as follows (*Dornbusch,* October 10th):—

	1910. Bushels.	1909. Bushels.
Winter Wheat	485,294,000	446,366,000
Spring Wheat	233,475,000	290,823,000
Oats...	1,096,396,000	1,007,353,000
Barley	158,138,000	170,284,000

Notes on the Potato Crop Abroad.

Germany.—The German Imperial Statistical Bureau estimates the numerical condition of the potato crop in the middle of September as 3·1 (2=good, 3=average, 4=poor), as compared with 2.8 in August, 1910, and 2·5 in September, 1909, and 2·7 for the ten-year average. It is stated that the condition of the crop, which was already being harvested in places, was much less favourable than in the preceding month. The earlier and finer varieties, especially those grown on heavy soils, suffered a good deal from disease. In the case of the later and stronger varieties, disease was not so widespread. The acreage for 1910 is estimated at 8,141,322 acres.

H.M. Ambassador at Berlin, in a dispatch dated September 3rd, states that the failure of the potato crop throughout Germany this year is likely to produce serious results, and will certainly necessitate the buying of potatoes abroad. The crop has been greatly affected by the prolonged wet season, and he is informed that the quality is only about 60 per cent. of the normal standard. Orders placed in Saxony by French dealers have been cancelled owing to the inferior quality of the potatoes supplied.

According to the *Deutsche Reichsanzeiger* (September 22nd), it may briefly be said of the potato harvest in Prussia that disease is everywhere rampant. It is, however, hoped that the hitherto very unsatisfactory reports will give place to better news if the fine weather continues. The condition of the crop in the middle of September was 3·0, compared with 2·7 in August. As showing the low condition

of the crop in some districts the following figures may be given:—Minden, 3·9; Hildesheim, 3·8; Erfurt, Arnsberg, and Cassel, 3·6; Hannover and Düsseldorf, 3·3.

According to the Prussian Statistical Bureau, the yield of potatoes was estimated in the middle of September at 30,000,000 tons, compared with 33,000,000 tons in 1909. (*Deutsche Reichsanzeiger*, September 26th.)

The *Wochenbericht der Preisberichtstelle des Deutschen Landwirtschaftsrats* (October 4th), in remarking on the potato crop prospects for the German Empire on October 1st, states that the yield is likely to be only about 82·3 per cent. of the normal.

Netherlands.—H.M. Consul at Rotterdam (Mr. H. Turing) reports that the winter onion crop of the Netherlands is a fairly average one. The potato crop is bad, with the result that prices have gone up 50 per cent., and exports will be small. (*Board of Trade Journal*, September 22nd.)

According to a report on the state of the crops published in the *Staatscourant* on September 23rd, the potato crop has proved rather unsatisfactory; the July rains have rotted large quantities, and disease has also been at work.

France.—A report in the *Journal d'Agriculture Pratique* of September 6th states that there will be a large deficit in the potato crop.

The German Consul at Marseilles stated on September 20th that reports as to the potato crop in the south of France were very unsatisfactory in all departments. The tubers are for the most part diseased, but have in some departments suffered from drought. The yield is hardly up to the average. (*Deutsche Reichsanzeiger*, September 26th.)

The British Consul at Lyons, reporting on agriculture in that neighbourhood on August 27th, states that potatoes have failed badly. The persistent cold and wet have favoured disease, and the crop is said to be absolutely destroyed in many parts. Prices had already risen, "earlies" having advanced from their normal rate of 55*s.* to 65*s.* per ton to 110*s.*, and it is expected that France will have to import large quantities of potatoes from Algeria and foreign countries. A list of firms in the district importing potatoes may be consulted at the Office of the Board.

Hungary.—The report published by the Ministry of Agriculture states that the potato crop is damaged and will not come up to expectations. The estimated yield on September 25th was 4,608,000 tons, compared with a previous estimate of 4,811,000 tons on August 9th.

Austria.—The report of the Ministry of Agriculture gives the condition of the potato crop in the middle of September as 2·9 (2 = over average, 3 = average). The crop had been partly harvested in the south of the country, while harvesting operations had commenced in the low-lying districts elsewhere. The crop had suffered from the wet, especially on heavy soils, and in those districts disease, both of the haulm and tubers, was becoming widespread. On lighter soils and in dryer districts conditions were more favourable, though in some places the tubers had suffered from mice and chafer larvæ. In the Carpathian districts both quantity and quality promised to be good. (*Deutsche Reichsanzeiger*, September 27th.)

Sweden.—The German Consul-General in Stockholm reported on September 20th that the potato crop in Sweden promises to be an average one except in north Sweden, where the yields are very light. Disease, however, is reported from all over the country. (*Deutsche Reichsanzeiger,* September 26th.)

United States.—The Crop Reporting Board of the United States Department of Agriculture estimates the average condition of potatoes on October 1st numerically as 71·8, compared with 78·8 on October 1st, 1909, and a ten-year average of 75·6. (*Dornbusch,* October 10th.)

The World's Hop Crop.

The estimate of Messrs. John Barth and Son, of Nuremberg, as to the hop production of the world was given in the *Journal* for September. Mr. C. J. Hoffer, hop estimator to the Bohemian Agricultural Council, in a report dated September 22nd, estimates the crop as an average one of 1,401,000 cwt., or about 500,000 cwt. more than in 1909, and 590,000 cwt. less than in 1908. The production of the various countries is given as follows :—

	1910. Cwt.	1909. Cwt.
Austria-Hungary	287,000	160,000
Germany	302,000	127,000
Holland and Belgium ...	51,000	29,000
France	44,000	24,000
Russia	43,000	49,000
England	295,000	197,000
United States	364,000	305,000
Australia	15,000	12,000
Total	1,401,000	903,000

The total area under cultivation is stated to be 235,000 acres, or a decrease as compared with the acreage in 1909. The acreage in Europe under hops has decreased generally, especially in Bohemia, Bavaria, and England, while the acreage in the United States has been increased by the addition of some 40,000 acres in the Pacific region.

The weather was very favourable to the growth of the hops until the middle of July, but the rainy weather which set in later dispelled all hopes of an excellent crop. The unfavourable weather continued during the harvesting period, and hindered both picking and drying operations. The quality is on the whole satisfactory, though the production of hops of first quality will be proportionately lower than in previous years. The crop is very unequal in development and colour.

The world's consumption of hops in 1910 is estimated at 1,535,000 cwt., and even this amount will not be covered by the production as estimated above. The stocks in the hands of brewers are thought to amount to between 150,000 cwt. and 200,000 cwt.

Messrs. John Barth and Son, of Nuremberg, have issued their second report on the hop crop, dated September 27th, and now estimate the total production of hops in 1910 as 1,483,000 cwt., against 924,000 cwt. in 1909, and 2,027,000 cwt. in 1908. Several Bavarian districts have harvested a fine crop. The south-west of Germany mostly gathered a satisfactory crop, but in parts of Prussia the reverse was

the case. The harvest of the Saaz district is disappointing, but other Austro-Hungarian districts generally had a fine and good yield.

The Board of Agriculture and Fisheries have been furnished by the Board of Trade with the following report, based on returns from correspondents in various districts, on the demand for agricultural labour in September:—

Agricultural Labour in England during September.

Employment was generally regular throughout the month, the dry weather which prevailed being favourable for outdoor work. There was a good demand for day labourers for the corn harvest, potato-lifting, threshing, hoeing, &c., but the supply of such men was usually sufficient for requirements.

Northern Counties.—The corn harvest and potato-lifting caused a good demand for day and other extra labourers in these counties, and the weather being fine most men had regular employment throughout the month. The demand for labourers was generally met by a full supply.

Midland Counties.—Employment was generally regular, and the supply of and demand for extra labourers were about equal. Several correspondents, however, referred to a smaller demand than usual for extra labourers on account of lighter corn crops. There was a surplus of such men in the Hayfield (*Derbyshire*) Union, and in parts of *Oxfordshire* and *Buckinghamshire*. In the Oakham (*Rutland*) Union, and in the Buntingford (*Hertfordshire*) Union there was some scarcity of extra men. There was also some scarcity of men for permanent situations in the Banbury (*Oxfordshire*) Union.

Eastern Counties.—There was a fairly good demand for extra labourers throughout the month, threshing, hoeing, manure carting, &c., providing employment after the corn harvest was finished. In certain districts a good many men were also employed at potato-lifting. The supply of labour was generally about equal to the demand, but some scarcity of extra labourers was mentioned in reports from the Bourne, Gainsborough, and Horncastle (*Lincolnshire*), and the Blything and Mildenhall (*Suffolk*) Unions.

Southern and South-Western Counties.—The continuous dry weather favoured employment in these counties as elsewhere, and agricultural labourers were mostly in regular work. Day labourers were, however, reported to be in excess of requirements in the Wilton (*Wiltshire*), and the Wareham and Purbeck (*Dorset*) Unions. In those districts where changes usually take place at Michaelmas the supply of men for permanent situations was generally said to be equal to the demand. A scarcity of such men was, however, reported in parts of *Hampshire* (where carters were in demand), *Gloucestershire,* and *Cornwall.*

THE CORN MARKETS IN SEPTEMBER.

C. KAINS-JACKSON.

During the past month a start has been made with new crop deliveries, but in the case of wheat the market sales have included an unusual proportion of old corn, and, in that of barley, have been limited for the most part to feeding grade. Sales of new oats have

been late in commencing, but there seem to be fair reserves of seasoned grain, and prices for the new have not been such as to stimulate delivery.

Wheat.—Some of the country markets, particularly in East Anglia, have retrograded until the average declared has been below 30*s*. The deliveries for which this low price has been accepted have been mostly of damaged grain that farmers thought had better be got out of the way and sold for what it would fetch. Despite the absence of high winds, there was this season a surprising amount of lodged and twisted corn very badly got, and secured in a sadly draggled state. At the Kentish, Surrey, and Berkshire markets some excellent new wheat has been offered, and has made up to 34*s*. 6*d*. for red, and 36*s*. for white. The crop as a whole is believed on the markets to have been secured in better condition than last year. Weight varies more than usual; perhaps a majority of Mark Lane samples have been averaging 62 lb. to the bushel. At the end of the month 32*s*. for 480 lb. lots, and 35s. for 504 lb. were the usual prices, and though not very encouraging to intending wheat sowers, they do not represent such absolute discouragement as might neutralise the influence of a favourable state of the soil for sowing. Imported wheat has given way about a shilling on the month, mainly on account of the colossal shipments of new crops from Russia and Europe S.E. Shipments for September were 2,916,000 qrs. from Russia, 2,551,000 from Europe S.E., 528,000 from Australasia, 340,000 from India, 505,000 from North America, and 487,000 from South America. The Russian total, though extremely remarkable, is not unprecedented, but the item, "Europe S.E.," has not even any near precedent, the highest previously recorded being 1,658,000 qrs. in September, 1905. The shipments of the New World and of India were below the average, otherwise the trade would have suffered from an overwhelming supply in prospect. The supply on passage to the United Kingdom on the last day of September, 2,140,000 qrs., was rather below the average, for the Continental buying from Russia and Europe S.E. in the last fortnight of the month was very active and a material stay to the British markets.

Flour.—The best London grade has fallen 1*s*. on the month, but the reduction to 33*s*. makes it a better business. Town Households are also 1*s*. down. Country flour has been in improved supply, and the makes from new crop wheat give a reasonable amount of satisfaction. About 23*s*. is a usual price at Cambridge, Ely, Norwich, and Ipswich, for all-English; London in many cases prefers to pay 25*s*., but to get for that price a half and half mixture of English and of strong foreign. Hungarian flour has steadied during the month; at 36*s*. to 38*s*. the leading brands find a good sale. It is difficult to quote American flour, as there is not only a distinct spot scarcity of several leading named kinds, but the offers for early winter shipment are erratic. Perhaps 31*s*. for fine Minneapolis, 30*s*. 6*d*. for best Kansas, 30*s*. for good Manitoba, and 28*s*. for secondary patents, whether U.S. or Canadian, were the prices most ordinarily made as September closed. France and Germany, despite their import needs of wheat, contrived during September to ship flour to London, where 34*s*. was made for fine French, 29*s*. 6*d*. to 30*s*. for best German, and 28*s*. for medium. A small cargo of Argentine flour came to hand, but South

America has not played any important part in the flour trade for some years past. There are only 138,000 sacks of flour now on passage, and America's September shipments were but 280,000 sacks.

Barley.—Chevallier barley of the new crop has been offering at Mark Lane, Bury St. Edmunds, Ipswich, and a few other markets at 32*s.* to 34*s.* per qr., and a little Goldthorpe in Somerset and Wiltshire at 31*s.* to 32*s.* Some fine Chevallier has been shown in Dorset, and has been held for 35*s.*, but markets are hard to report for tip-top lots, the brewers' travellers visiting the farms noted for good barley and much of the business passing in the farmer's parlour. Quantity deliverable, date of assured supply, and so forth play material parts in the bargain. The price of Russian feeding barley has receded to an average of about 18*s.*, but this is mainly due to the wretched state in which so much of it is put ashore on our quays. Other barley sales at the end of September included new Smyrna at 29*s.* per 448 lb., new Turkish (from Salonica) at 23*s.* per 400 lb., and some Australian brewing at 28*s.* per 448 lb. No Saale, Hungarian, or Moravian new crop appeared to be offering, and both Chilian and Californian were scarce. On the 30th the large total of 640,000 qrs. was on passage, but consisted mainly of inferior feeding. September shipments were 2,923,000 qrs. from Russia, 309,000 from Europe S.E., 42,000 from California and Oregon, and 15,000 from Persia.

Oats.—Very irregular results from the first home threshings are recorded, and farmers putting poor stuff on sale to effect an early clearance have been the cause of several market averages below 16*s.* per qr. The price of good new 336 lb. oats has been from 19*s.* to 20*s.* at nearly all markets, and buyers have not been backward. Judging from the market sales for autumn sowing the area under what are called winter oats may conceivably show some increase. The 304 lb. oats from Russia and Argentina have continued in free offer at 14*s.* to 14*s.* 6*d.* per qr. Shipments for September were 25,000 qrs. from North America, 86,000 from South America, 782,000 from Russia, and 38,000 from Europe S.E. On the 30th there were 310,000 qrs. on passage.

Maize.—There have been good sales of this staple, but still not quite enough to balance the heavy supplies. Argentina has been a busy shipper of late, and the arrivals from South America during September much exceeded the average. Prices were consequently difficult to maintain, and 23*s.* was accepted for yellow corn (the type produced by Argentina) at the close of the month. Russian and Roumanian round maize, which have been in fairly good supply, have kept nearly up to 25*s.*, and at some inland markets exceed that price. Mark Lane, however, closed with 24*s.* 3*d.* *ex* quay accepted from buyers for cash. The quantity of maize on passage, 1,270,000 qrs., was very heavy, but this is a date at which a large total is usual. A year ago 900,000 qrs. were afloat. September shipments were 304,000 qrs. from South America, 100,000 qrs. from Russia, and 89,000 qrs. from Europe S.E.

Oilseeds.—During September the supply of linseed and cottonseed on passage was gradually declining, so that on the 30th the totals were only 77,000 qrs., and 10,000 tons respectively. Linseed closed at 77*s.* per 410 lb. for Calcutta, 71*s.* per 416 lb. for Argentine, 72*s.* per 416 lb. for

Russian. The promise of the growing crop in Argentina was stated to have improved considerably during the month, but this only adds to the significance of the above figures, which we have seen to have been ruling after such advices. Had Argentine crops, which August drought had put in jeopardy, retrograded, the Michaelmas prices for linseed must have been of quite a fancy description. Cottonseed closed September with £9 12*s.* 6*d.* per ton obtainable for Egyptian on spot, The new crop for November shipment was offered at £1 per ton under the spot price. This new Egyptian crop, which will be in the gathering by the time this article is published, was in late September expected on semi-official estimates to be a very large one; should it prove so, it will come most opportunely to relieve a market in which the shortness of supply has been much felt.

Various.—New English beans have arrived on sale in increased quantity, and the quality is superior to that of last year. New English peas and rye, though crops of very different type, are alike in the wide range of quality shown by samples. Beet-sugar has come down to 11*s.* per cwt., as the new make from Central Europe will shortly be available. Rice has been a slow trade here, but value has been well maintained, the crop news from Japan, an important producer, being adverse.

THE LIVE AND DEAD MEAT TRADE IN SEPTEMBER.

A. T. MATTHEWS.

Fat Cattle.—As Michaelmas approached, the end of the season for finishing cattle satisfactorily on the pastures became every week more visible in the condition of the cattle coming to market, and it was inevitable that prices must suffer to some extent. There are good grounds for believing, however, that the moderate reduction in the averages during September was entirely owing to the want of finish, and that if the quality could have been maintained there would have been no decline at all. It is significant that all descriptions of prime dead beef have about maintained their values, and also that at almost the only market where stall-fed beasts were to be found, viz., at Ipswich, the average for first quality Shorthorns was as high as that of June, when beef touched its highest point. Compared with the prices of a year ago those now ruling are higher by nearly ½*d.* per lb.

The average price of Shorthorns in about twenty-one English markets during September was 8*s.* 8¼*d.* per stone, against 8*s.* 10½*d.* in August. Second quality averaged 7*s.* 9¾*d.*, and third 6*s.* 10*d.*, these figures showing a very similar decline. The fall in Herefords was also about 2*d.* per stone, their averages being 8*s.* 11*d.* and 8*s.* 2*d.* for first and second quality. Devons showed practically as good an average as in August, realising 9*s.* 0½*d.* and 8*s.*, against 9*s.* 1*d.* and 8*s.* 0½*d.* per 14 lb. The trade for cattle in Scotland was again rather firmer than in the English markets, and in the third week fine bullocks at Edinburgh made up to 48*s.* per live cwt.

Veal Calves.—There has been a steady demand for fat calves, and

with moderate supplies prices showed little or no change. Individual markets varied to some extent, but the general average price was again $8\frac{1}{2}d.$ and $7\frac{1}{2}d.$ per lb., in about twenty-six leading markets.

Fat Sheep.—The sheep trade may be described as very steady in its general character, especially in view of the scarcity of those handy small weights suitable to the modern demand. September falls between the seasons for prime mutton, and therefore the fact that the averages for Downs were virtually unchanged may be taken as fairly encouraging. There was considerable uniformity in values throughout the country, London holding steadily about an average place. Many heavy, long-woolled sheep were offered at Islington which failed to attract buyers, and it seems surprising that senders should not perceive that 90 lb. to 100 lb. sheep are quite unsuitable for the London trade. Only in those southern markets where the Southdowns are found has $8\frac{1}{2}d.$ per lb. been reached as the average top price of "Downs," while in about eighteen English markets the widely varying breeds which are so classed worked out at $8d.$, $7d.$, and $5\frac{1}{2}d.$ for the three qualities respectively. "Longwools" is also a term used to describe breeds differing widely in size and quality, but in these the month of September showed a change in average values of about $\frac{1}{4}d.$ per lb. The figures in August were $7\frac{1}{2}d.$, $6\frac{3}{4}d.$, and $5\frac{1}{4}d.$, and in September $7\frac{1}{4}d.$, $6\frac{1}{2}d.$, and $5d.$ In Scotland Crossbreds fetched $8\frac{1}{2}d.$ in many markets, and in the third week were quoted at $9d.$ at Stirling.

Fat Lambs.—Lambs continued to be offered in about thirty markets of England and Scotland, but their extra value as compared with mutton was small. The August averages of $8\frac{3}{4}d.$ and $7\frac{3}{4}d.$ per lb. for first and second quality were maintained till the third week, when they declined $\frac{1}{4}d.$

Fat Pigs.—Bacon pigs were practically unchanged in value, and averaged $8s.$ $2d.$ and $7s.$ $7d.$ per stone for first and second quality in about thirty markets.

Carcass Beef—British.—As already stated, the price of beef of good quality remains remarkably firm. Scotch was almost entirely represented in the Central London Market by short sides, which were worth $7\frac{1}{2}d.$ to $7\frac{3}{4}d.$ per lb. throughout the month. A few long sides in the last week fetched $7\frac{1}{4}d.$ English beef was sparingly offered, and then was only of second quality, fetching $6\frac{1}{4}d.$ per lb.

Port-Killed Beef.—This trade has become of quite second-rate importance in the London market, supplies getting more and more limited. The averages for "town-killed" United States beef were $6\frac{1}{4}d.$ and $6d.$ for first and second quality.

Chilled Beef.—This article showed more fluctuation during September than any other description of beef. That from the States was very limited in quantity, and ranged from $6\frac{1}{2}d.$ to $6\frac{3}{4}d.$ for best hindquarters, the best forequarters fetching about $4d.$ per lb. Argentine chilled met a bad trade in the first three weeks, being in over supply. Prime hindquarters then advanced $\frac{3}{4}d.$, and left off at $5\frac{1}{4}d.$ per lb. The best forequarters were very cheap, and large quantities were sacrificed at almost nominal rates. From $2\frac{3}{4}d.$ for the best quality, quotations advanced to $3\frac{1}{4}d.$ per lb. in the last week.

Frozen Beef.—"Hard" beef was steady in value, and best hindquarters were worth $3\frac{3}{8}d.$ as the average for the month.

Carcass Mutton—Fresh Killed.—The London trade, which fairly reflected that of the country, was very slow for fresh-killed mutton. Even the finest small Scotch never exceeded $7\frac{1}{2}d.$ per lb., and in the last week $7\frac{1}{4}d.$ was realised with difficulty. The best English on offer was steady at $6d.$ to $6\frac{3}{8}d.$ per lb. The finest quality of English mutton, however, such as the Southdown, is never seen at Smithfield. Dutch mutton was freely offered and sold at $5\frac{3}{4}d.$ to $6d.$ per lb. throughout. "Lamb," which was, of course, sold as mutton, realised up to $7\frac{1}{2}d.$ per lb.

Frozen Mutton.—In the third week frozen mutton was held with great firmness by shippers, and prices advanced, though the market was slow. At the end of the month the best "Canterbury" touched $4\frac{1}{2}d.$ per lb., and Argentine $3\frac{7}{8}d.$

Lamb.—British lamb fetched no more than small mutton, but New Zealand of first quality advanced to $5\frac{5}{8}d.$ per lb.

Veal.—There was a fair demand for veal at steady prices. In London the finest Dutch averaged $8\frac{1}{4}d.$, and English $8d.$ per lb.

Pork.—The season commenced this month, and the trade was brisk during cool weather, but declined no less than $\frac{3}{4}d.$ per lb. when the warm spell set in. Prices of best English ranged from $7\frac{1}{4}d.$ at the lowest to $8d.$ at the highest point.

THE PROVISION TRADE IN SEPTEMBER.

HEDLEY STEVENS.

Bacon.—The exceptionally fine weather during September gave a better tone to the market, and early in the month prices generally were higher. This applied especially to side meats, the arrivals being very moderate in quantity. By the end of the month, however, Wiltshire prices had again receded, with freer arrivals from Denmark and a smaller demand, leaving quotations about 2*s.* per cwt. under those current at the commencement of the month. Canadian sides were the only exception; these were being held for 2*s.* per cwt. advance, on account of very small arrivals.

Arrivals from America continue on the moderate side, but importers have reduced their prices in order to keep stocks moving, as they are nervous of holding at present high prices. American hogs have fluctuated considerably during the month, ranging from $8.15 to $10.00, but on the whole the quantities marketed have been a little in excess of the previous month. The latest advices from the United States point to the present high prices continuing longer than was expected, the quantity of pigs available being below that anticipated.

American lard was dearer at the end of the month, but packers have been willing to contract for January shipment at from 6*s.* to 7*s.* per cwt. below that demanded for September shipment.

Russian and Siberian sides continue to command attention, and the best selections of the former were cleared as soon as landed at within 2*s.* to 3*s.* per cwt. of that made for best Dutch. Small quantities of cured meats are still arriving from Australia, and were readily cleared during the month at around 70*s.* to 73*s.* The only fault to be found with this meat is that the cure is a little hard.

English and Irish pigs are slightly cheaper on the month. Curers continue to complain of the shortage in the numbers available, and find trading difficult in competition with the cured product of other countries.

Cheese.—The trade has again been unsatisfactory, both in regard to the volume of business and prices obtainable, as although the Canadian August makes have been on the market it has been difficult to secure a higher figure for this description, and prices show very little change for the entire month. The make of cheese in our own country has continued good, but dealers complained of a large percentage of irregular quality on offer, brought about by the wet season. Strictly fancy selections realised full prices, but all offerings below this description have been bought at several shillings per cwt. less.

Prices cabled from Canada have shown little variation during the month, and importers have been able to contract the September makes at practically the same prices as the earlier or inferior makes. The exports from Canada for the season up to September 17th show a decrease of, roundly, 35,000 cheeses. At the end of the month the estimated stock of Canadian cheese at the three principal distributing centres (London, Liverpool, and Bristol) were 363,000 boxes, against 325,000 last year, and 313,000 two years ago. This shows an increase of 38,000 boxes over last year, and with the smaller shipments mentioned above, a decrease in the consumption of 73,000 boxes of Canadian cheese. In the United States best cheese is making 70*s.* to 72*s.* per cwt.

Buyers continue to hold off from contracting the new season's New Zealand cheese, the price demanded (56*s.* 6*d.* to 57*s.* c.i.f.) being in their opinion too high.

Butter.—The demand has been fair for strictly best descriptions, but the lower grades, of which large stocks are held in cold store, are difficult to sell, chiefly on account of the exceptionally mild weather experienced throughout the month. With colder weather these would doubtless more readily go into consumption. Prices show only very small changes during the month. The arrivals from Australia have been large for the time of year, but unusually small from New Zealand. Advices from both these countries report weather conditions as favourable for a large make.

Arrivals from Canada continue very small. In the United States best selections are making equal to 150*s.* to 154*s.* c.i.f.

Eggs.—A fair trade has passed, though the high prices have somewhat curtailed consumption. Most descriptions are 1*s.* to 2*s.* dearer on the month.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and SCOTLAND in the Month of September, 1910.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	England.		Scotland.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per cwt.†	per cwt.†
Cattle:—	s. d.	s. d.	s. d.	s. d.
Polled Scots	8 10	8 2	43 3	39 0
Herefords	8 10	8 3	—	—
Shorthorns	8 8	7 10	42 3	38 2
Devons	9 1	8 0	—	—
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	8¼	7½	8½	7
Sheep:—				
Downs	8	7	—	—
Longwools	7¼	6½	—	—
Cheviots	8	7¼	8¼	7¼
Blackfaced	7¾	7	7¾	6¾
Cross-breds	8	7¼	8½	7½
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs:—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	8 2	7 9	8 0	7 1
Porkers	8 7	8 1	8 3	7 5
LEAN STOCK:—	per head.	per head.	per head.	per head.
Milking Cows:—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	22 6	18 15	23 1	18 11
,, —Calvers... ...	22 1	18 17	20 18	17 6
Other Breeds—In Milk ...	19 1	16 4	19 18	16 11
,, —Calvers ...	16 5	14 15	20 0	16 11
Calves for Rearing	2 7	1 16	2 10	1 12
Store Cattle:—				
Shorthorns—Yearlings ...	10 11	9 2	11 1	8 10
,, —Two-year-olds...	14 17	13 0	15 6	13 12
,, —Three-year-olds	18 9	15 8	18 4	15 19
Polled Scots—Two-year-olds	—	—	17 6	14 18
Herefords— ,,	16 5	14 12	—	—
Devons— ,,	14 13	13 5	—	—
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	32 7	27 6	—	—
Scotch Cross-breds ...	—	—	26 1	21 5
Store Pigs:—				
Under 4 months	32 8	26 2	25 4	20 6

* Estimated carcass weight.

† Live weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND and SCOTLAND in the Month of September, 1910.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Quality.	Birmingham.		Liverpool.		London.		Manchester.		Edinburgh.		Glasgow.	
		per cwt.		per cwt.		per cwt.		per cwt.		per cwt.		per cwt.	
		s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
BEEF :—													
English	1st	57	0	57	0	—		55	0	62	6*	66	0*
	2nd	51	6	54	0	57	0	52	6	55	0*	60	6*
Cow and Bull ...	1st	51	0	48	6	49	6	48	6	48	0	51	6
	2nd	43	6	42	0	43	0	44	6	42	6	41	0
U.S.A. and Canadian :—													
Port Killed ...	1st	55	6	56	0	59	0	53	6	—		57	0
	2nd	51	6	52	6	56	6	51	6	51	6	51	6
Argentine Frozen—													
Hind Quarters...	1st	33	0	33	0	31	6	33	0	33	6	33	6
Fore ,, ...	1st	26	0	25	0	24	6	25	6	26	6	26	0
Argentine Chilled—													
Hind Quarters...	1st	43	6	40	6	44	6	41	6	42	6	43	6
Fore ,, ...	1st	28	0	27	6	27	6	27	6	29	0	28	0
American Chilled—													
Hind Quarters—	1st	—		—		62	6	—		62	0	—	
Fore ,, ...	1st	—		—		39	0	—		41	0	—	
VEAL :—													
British	1st	66	0	75	0	74	6	72	6	—		—	
	2nd	55	6	70	6	65	6	65	6	—		—	
Foreign	1st	—		—		78	6	—		72	6	—	
MUTTON :—													
Scotch	1st	—		66	0	69	0	—		66	0	67	6
	2nd	—		61	0	66	0	—		56	6	51	6
English	1st	64	6	61	0	62	0	62	0	—		—	
	2nd	50	0	56	6	57	6	57	6	—		—	
Argentine Frozen ...	1st	34	6	32	6	32	6	32	6	35	0	34	0
Australian ,, ...	1st	33	0	30	0	31	6	30	0	—		32	0
New Zealand ,, ...	1st	—		—		38	6	—		—		—	
LAMB :—													
British	1st	64	0	65	0	71	6	63	0	67	6	69	6
	2nd	58	0	59	6	65	6	59	6	56	0	54	0
New Zealand ...	1st	51	0	50	0	50	6	50	0	52	0	52	6
Australian	1st	46	6	44	0	43	6	44	0	—		45	6
Argentine	1st	44	6	43	6	41	6	43	6	—		44	6
PORK :—													
British	1st	70	6	72	0	70	0	71	6	66	6	66	0
	2nd	63	6	66	6	63	6	66	6	59	0	—	
Foreign	1st	—		—		67	6	—		—		—	

* Scotch.

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1908, 1909 and 1910.

Weeks ended (*in* 1910)	Wheat. 1908.	Wheat. 1909.	Wheat. 1910.	Barley. 1908.	Barley. 1909.	Barley. 1910.	Oats. 1908.	Oats. 1909.	Oats. 1910.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Jan. 1 ...	35 1	32 0	33 3	26 9	26 7	25 1	18 4	17 4	17 4
,, 8 ...	35 2	32 9	33 6	26 9	26 11	24 11	18 3	17 5	17 2
,, 15 ...	35 5	32 8	33 8	27 1	27 1	24 11	18 5	17 5	17 7
,, 22 ...	35 6	33 2	33 9	26 11	27 3	24 11	18 5	17 8	17 6
,, 29 ...	35 0	33 0	33 6	26 11	27 6	25 0	18 4	17 9	17 4
Feb. 5 ...	34 3	33 4	33 7	26 9	27 7	24 10	18 3	17 10	17 7
,, 12 ...	33 1	33 8	33 4	26 9	27 8	24 9	18 0	17 11	17 11
,, 19 ...	32 6	34 1	33 0	26 5	27 11	24 6	17 11	18 0	18 0
,, 26 ...	30 11	34 5	32 7	26 3	28 0	24 2	17 8	18 0	17 10
Mar. 5 ...	30 5	34 10	32 7	26 1	27 11	24 6	17 8	18 2	18 1
,, 12 ...	31 3	35 8	32 6	26 0	28 4	24 1	17 10	18 2	18 0
,, 19 ...	31 7	35 9	32 6	26 2	28 0	23 6	17 11	18 5	18 0
,, 26 ...	31 4	36 0	32 9	25 10	28 0	23 7	17 10	18 6	17 11
Apl. 2 ...	31 3	36 5	33 0	25 5	27 10	23 8	17 9	18 8	18 0
,, 9 .	31 2	37 4	33 6	25 10	28 0	23 1	17 7	18 10	17 11
,, 16 ...	30 11	38 7	33 7	26 1	27 8	23 5	17 7	19 2	18 3
,, 23 ...	30 10	41 4	33 7	25 5	28 2	23 0	17 9	19 9	18 3
,, 30 ...	31 6	42 5	33 0	25 8	27 10	22 10	18 0	20 0	18 3
May 7 ...	32 4	40 9	32 6	25 5	27 7	22 7	18 4	20 3	18 2
,, 14 ...	33 1	41 6	32 1	24 9	27 3	22 0	18 7	20 6	18 1
,, 21 ...	33 8	42 8	31 10	25 9	27 0	21 8	18 10	20 11	17 8
,, 28 ...	33 5	42 6	31 3	24 6	26 3	21 4	18 8	21 0	17 10
June 4 ...	33 1	43 1	30 2	25 10	25 7	21 8	18 4	21 3	17 10
,, 11 ...	32 7	42 11	29 1	24 5	26 10	20 9	18 4	21 4	17 10
,, 18 ...	32 0	42 7	29 0	24 2	26 10	18 11	18 5	21 6	18 0
,, 25 ...	31 5	42 8	29 4	24 0	27 2	20 1	18 7	21 7	17 9
July 2 ...	30 11	42 9	29 9	23 11	27 2	19 11	18 7	21 9	17 7
,, 9 ...	30 5	43 0	30 4	24 4	26 4	19 5	18 5	21 8	17 4
,, 16 ...	30 7	43 3	31 1	23 1	26 10	21 3	18 5	21 9	17 7
,, 23 ...	31 5	44 0	31 11	26 5	27 4	19 9	18 6	22 5	17 5
,, 30 ...	31 10	43 5	33 5	24 4	24 6	20 10	18 7	22 2	18 1
Aug. 6 ..	31 6	44 9	33 9	23 1	27 4	20 5	18 9	22 11	18 3
,, 13 ...	31 6	44 9	33 5	23 10	24 9	20 4	18 1	21 8	18 0
,, 20 ...	31 2	41 6	32 11	24 5	23 11	20 11	17 10	19 8	17 11
,, 27 ...	30 10	38 5	32 7	24 5	24 7	20 10	17 1	19 4	17 2
Sept. 3 ...	30 10	37 2	32 2	25 5	26 3	22 10	17 3	19 6	17 2
,, 10 ...	31 5	34 11	31 11	25 11	26 1	23 3	17 6	18 5	17 2
,, 17 ...	31 7	33 6	30 11	26 0	26 5	24 3	17 3	17 9	16 6
,, 24 ...	31 5	32 9	30 2	26 8	26 8	24 2	17 2	17 7	16 3
Oct. 1 ...	31 7	32 2	30 1	26 11	26 9	24 4	17 2	17 2	16 4
,, 8 ...	31 5	31 8	30 1	27 5	26 9	24 7	17 0	17 0	16 3
,, 15 ...	31 2	31 4		27 6	27 0		17 0	17 0	
,, 22 ...	30 11	31 8		27 5	27 7		16 11	16 11	
,, 29 ...	30 8	31 10		27 5	27 9		16 11	17 0	
Nov. 5 ...	30 11	32 5		27 6	27 9		17 0	17 0	
,, 12 ...	31 2	32 5		27 4	27 7		17 0	17 1	
,, 19 ...	31 10	32 7		27 3	27 0		17 3	17 4	
,, 26 ...	32 3	33 0		27 2	26 8		17 5	17 3	
Dec. 3 ...	32 7	33 3		27 2	26 1		17 4	17 4	
,, 10 ...	32 8	33 3		27 0	25 7		17 4	17 3	
,, 17 ...	32 9	33 2		26 9	25 3		17 3	17 4	
,, 24 ...	32 2	33 1		26 8	25 2		17 2	17 4	

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lbs.; Barley, 50 lbs.; Oats, 39 lbs. per Imperial Bushel.

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE, BELGIUM, and GERMANY, and at PARIS, BERLIN, and BRESLAU.

—		Wheat.		Barley.		Oats.	
		1909.	1910.	1909.	1910.	1909.	1910.
		s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
France:	August	41 6	45 8	27 0	25 4	22 10	21 3
	September	39 6	46 1	25 9	25 5	20 9	21 1
Paris:	August	42 6	48 10	29 2	23 11	24 8	22 1
	September	41 5	48 10	27 7	24 8	19 8	21 8
Belgium:	July	48 0	33 10	26 1	22 4	26 8	20 2
	August	42 8	34 6	24 8	22 1	24 5	20 0
Germany:	July	58 2	41 11	29 9	24 3	28 4	20 11
	August	49 1	41 7	28 4	24 5	24 5	20 3
Berlin:	July	55 10	45 4	—	—	25 3	21 0
	August	51 10	42 6	—	—	23 9	21 3
Breslau:	July	58 4	40 11	— (brewing) 26 0 (other)	— (brewing) 22 11 (other)	26 7	19 8
	August	53 2	38 4	28 11 (brewing) 25 9 (other)	— (brewing) 22 11 (other)	26 5	20 3

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*, the prices for the German Empire representing the average of the prices at a number of markets.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of September, 1909 and 1910.

—	Wheat.		Barley.		Oats.	
	1909.	1910.	1909.	1910.	1909.	1910.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
London	35 7	32 10	27 7	24 7	18 6	17 5
Norwich	34 4	31 0	25 11	25 1	17 7	16 2
Peterborough	33 1	30 1	26 2	23 9	17 4	16 1
Lincoln	35 5	30 10	26 4	22 9	18 1	17 4
Doncaster	32 6	32 4	26 9	22 4	20 5	17 10
Salisbury	35 1	30 9	25 2	22 1	18 3	17 0

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND and SCOTLAND in the Month of September, 1910.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Bristol.		Liverpool.		London.		Glasgow.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12lb.
British ...	13 6	12 6	—	—	13 6	12 0	14 0	—
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery	116 6	113 6	112 6	110 0	117 0	112 6	114 0	—
,, Factory	105 0	100 0	101 0	95 0	105 0	99 0	—	—
Danish ...	—	—	118 6	116 6	118 0	116 0	117 0	—
French ...	105 0	99 0	—	—	115 6	112 6	—	—
Russian ...	109 0	101 6	106 6	102 6	108 0	106 0	106 0	102 0
Canadian ..	117 6	113 0	113 0	111 0	116 0	114 0	114 0	—
Australian ...	112 0	108 0	—	—	116 0	113 0	118 0	—
New Zealand	120 0	112 0	—	—	116 0	—	—	—
CHEESE :—								
British—								
Cheddar ...	71 0	61 0	70 6	67 0	72 0	67 0	58 0	54 0
			120 lb.	120 lb.	120 lb.	120 lb.		
Cheshire ...	—	—	66 0	61 0	71 6	62 0	—	—
			per cwt.	per cwt.	per cwt.	per cwt.		
Canadian ...	55 0	53 6	54 6	53 0	55 0	54 0	55 0	53 0
BACON :—								
Irish	82 0	78 0	80 0	76 6	83 0	77 6	83 6	80 6
Canadian ...	76 0	73 6	75 6	73 6	73 6	—	77 0	75 0
HAMS :—								
Cumberland ...	—	—	—	—	112 6	103 0	—	—
Irish	—	—	—	—	108 0	99 6	109 6	104 0
American (long cut) ...	81 6	77 6	79 0	74 0	77 6	74 0	78 6	76 0
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British ...	11 10	11 0	—	—	13 1	12 1	—	—
Irish	10 5	9 7	10 11	9 7	11 6	10 7	10 4	9 4
Danish ...	11 6	10 9	10 10	10 2	11 4	9 10	10 7	9 2
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
British Queen.	68 0	58 0	58 6	53 6	62 0	54 0	44 0	37 6
Edward VII...	65 0	60 0	53 6	—	65 0	57 6	—	—
Up-to-Date ...	65 6	56 6	55 0	50 0	63 0	53 0	40 0	35 0
HAY :—								
Clover ...	94 0	79 0	94 6	70 0	101 6	83 6	74 0	62 0
Meadow ...	79 6	62 6	—	—	89 0	72 0	—	—

DISEASES OF ANIMALS ACTS, 1894 to 1910.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

Disease.	September.		Nine Months ended September.	
	1910.	1909.	1910.	1909.
Swine-Fever:—				
Outbreaks	90	74	1,090	1,323
Swine Slaughtered as diseased or exposed to infection ...	1,006	992	9,864	11,987
Anthrax:—				
Outbreaks	87	81	1,086	986
Animals attacked	89	99	1,295	1,310
Foot-and-Mouth Disease:—				
Outbreaks	—	—	2	—
Animals attacked	—	—	15	—
Glanders (including Farcy):—				
Outbreaks	37	45	292	420
Animals attacked	83	140	859	1,500
Sheep-Scab:—				
Outbreaks	11	5	350	476

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)

Disease.	September.		Nine Months ended September.	
	1910.	1909.	1910.	1909.
Swine-Fever:—				
Outbreaks	2	4	73	86
Swine Slaughtered as diseased or exposed to infection ...	15	56	1,713	1,561
Anthrax:—				
Outbreaks	—	1	5	6
Animals attacked	—	1	8	6
Glanders (including Farcy):—				
Outbreaks	—	—	1	—
Animals attacked	—	—	2	—
Sheep-Scab:—				
Outbreaks	16	4	364	309

ADDITIONS TO THE LIBRARY.

[NOTE.—The receipt of *annual* publications of foreign agricultural and other departments, experiment stations and societies is not noted in the monthly list of additions to the Library. A list of these publications appeared in the *Journal* for October, November and December, 1909.]

Agriculture, General and Miscellaneous—

University of Leeds.—Bull. No. 78:—Guide to Experiments at the Manor Farm, Garforth, 1910. (35 pp.) [B. 46.] Bull. No. 79:—The Distribution of the Manure Values of Foods between Dung and Urine. (18 pp.) [B. 24.] Leeds, 1910.

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Spampani, G.—Coltura Montana con speciale riguardo alla Alpicoltura. (424 pp.) Milan: Ulrico Hoepli, 1910. [B. 12.]

Krische, Dr. P.—Die Verwertung des Kali in der Landwirtschaft. (32 pp.) Berlin: Verlag für bergbaul. und industrielle Fachliteratur, 1910. 4*s.* [B. 32.]

Colorado Agricultural Experiment Station.—Bull. No. 160:—Nitrates in the Soil. (8 pp.) Fort Collins, Colorado, 1910. [B. 40.]

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Maier-Bode, F.—Die Organisation und die Erfolge des landwirtschaftlichen Wanderunterrichts im Königreich Bayern. (375 pp.) Landsberg a. L: G. Verza, n.d. 7 m. 50. [B. 44.]

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Howard, A., and *Howard, G. L. C.*—Wheat in India. Its Production, Varieties, and Improvement. (288 pp.) Calcutta: Thacker Spink and Co., 1910. (For the Imperial Department of Agriculture in India.) [C. 2.]

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Sawer, E. R.—Cedara Memoirs on South African Agriculture. Vol. I:—Cereals in South Africa. (343+xviii pp.) Pietermaritzburg, 1909. [C. 22.]

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New South Wales, Dept. of Agriculture.—Farmers' Bull. No. 41:—Varieties of Wheat Recommended by the Department of Agriculture. (24 pp.) Sydney, 1910. [C. 2.]

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Cornell University Agricl. Experiment Station.—Bull. No. 273:—The Effect of Fertilisers applied to Timothy on the Corn Crop following it. (53–76 pp.) [C. 22.] Bull. No. 279:—Variation and Correlation in Timothy. (299–350 pp.) [C. 44.] Bull. No. 280:—Pastures in New York. (351–397 pp.) Ithaca, New York, 1910. [C. 42.]

Gloucester Education Committee, Agricultural Dept.—Report on Swede Trials, 1909. (8 pp.) 1910. [C. 32.] Report on Mangel Experiments, 1909. (13 pp.) 1910. [C. 32.] Report on the Manuring of Potatoes, 1909. (10 pp.) 1909. [C. 26.] Gloucester.

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U.S. Dept. of Agriculture, Bureau of Plant Industry.—Bull. No. 172:—Grape Investigations in the Vinifera Regions of the United States with Reference to Resistant Stocks, Direct Producers, and Viniferas. (86 pp.) Washington, 1910. [D. 48.]

Wallem, H.—Die Elektrizität in der Landwirtschaft und deren Beziehungen zu Überlandzentralen. (46 pp.) Berlin: J. Springer, 1910. [D. 24.]

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Purdue University Agricultural Experiment Station.—Bull. 138:—The San Jose Scale, Some Sprays for its Control. (73–86 pp.) Lafayette, Indiana, 1910. [E. 40.]

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Live Stock—

Commonwealth of Australia.—Report on the Meat Export Trade of Australia. (15 pp.) Melbourne, 1910. [F. 70.]

Purdue University Agricultural Experiment Station.—Bull. No. 141:—Concentrated Commercial Feeding Stuffs. (165–440 pp.) [F. 74.] Bull. No. 142:—Steer Feeding *v.* Finishing Steers, 1907, 1908, and 1909. (441–474 pp.) [F. 68.] Lafayette, Indiana, 1910.

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Transvaal Department of Agriculture.—Science Bull. No. 6:—Composition of Milk. (8 pp.) [G. 56.] Farmers' Bull. No. 126:—Reduktase Test. (2 pp.) [G. 54.] Pretoria, 1910.

Commonwealth of Australia.—Report on the Butter Export Trade of Australia. (16 pp.) Melbourne, 1910. [G. 60.]

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Macewen, H. A.—The Public Milk Supply. (182 pp.) London: Blackie and Son, 1910. 2*s.* 6*d.* net. [G. 56.]

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New York Agricl. Experiment Station.—Bull. No. 322:—The Individual Animal as the Unit in Profitable Dairying. (16 pp.) Geneva, New York, 1910. [G. 50.]

U.S. Dept. of Agriculture.—Farmers' Bull. No. 413:—The Care of Milk and its Use in the Home. (20 pp.) Washington, 1910. [G. 56.]

Corporation of London, Public Health Dept.—Report by the Medical Officer of Health on the Use of Preservatives in Articles of Food. (13 pp.) 1910. [G. 72.]

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Dun, F.—Veterinary Medicines, their Actions and Uses. (Revised and edited by J. Macqueen and H. A. Woodruff.) (822 pp.) Edinburgh, D. Douglas, 1910. [H. 28.]

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Birds, Poultry, Bees, &c.—

Digges, J. G.—The Practical Bee Guide. Second edition. (229 pp.) London: Simpkin, Marshall and Co., n.d. 2*s.* net. [K. 16.]

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ON THE OCCURRENCE OF "CROWN-GALL" IN ENGLAND.

DURING the present season, examples of plum, rose, raspberry and chrysanthemum plants have been received at Kew for investigation, each bearing irregularly globose, nodulose galls or swellings originating from the crown or collar region of the stem. The galls varied in size from a pea to that of a cricket ball, and one gall at the base of a rose stem measured seven inches in diameter. Small galls were in some examples also present on the branches of the root. Most of the galls were in an exolete or woody condition, and gave no indication of the true cause of their formation. Mycelium was present in some instances in the dead tissues, and various conidial conditions of fungi were not uncommon in the crannies present on the surface, but nothing of a nature that suggested, from analogy, an organism capable of inducing the formation of a gall.

It was not until a batch of *Chrysanthemum frutescens*, L., having the base of the stems covered with large excrescences, was examined, that the true nature of the gall was discovered. This proved to be the well-known and very destructive disease called "crown-gall" in the United States. The galls are caused by *Dendrophagus globosus*, Toumey, one of the Myxogastres, allied to *Plasmodiophora brassicæ*, Woronin, the cause of "finger-and-toe" or "anbury" on the roots of many cruciferous plants. When a section of a gall in active growth is examined under the microscope, strands of plasmodium are seen permeating the tissues of the gall in every direction. Eventually the plasmodium concentrates in the peripheral cells forming the gall, and from thence

passes on to its free surface, where numerous minute, globose, yellow sporangia or fruit-bodies are formed. If a gall containing the organism in an active, or swarming condition is allowed to dry, the plasmodium concentrates into compact masses, and passes into a resting condition. On the application of moisture these resting masses of plasmodium gradually expand and assume an active condition, moving from cell to cell through the wall-pits, and consuming the contents of the cells. "Crown-gall" is considered as a very serious disease in the United States. Hundreds of thousands of fruit trees have been killed by it when growing in the best soil, and with the best treatment. The subject has been very carefully worked out by Toumey, who describes the galls as occurring on the following trees: peach, apricot, almond, prune, plum, apple, pear, English walnut and grape, cherry, poplar, chestnut, raspberry, and blackberry.

Seedlings from one to six months old are most susceptible to the disease. The galls appear in the region of the collar or on the larger roots. A gall commences growth as a very minute, smooth, colourless, wart-like body, often attached to the stem or root by a narrow neck. Growth is rapid, and the surface of the gall becomes nodulose or warted, and darkens in colour. The galls usually decay at the end of one season's growth, and leave an open wound which extends for some distance into the wood. The following spring gall formation commences round the margin of the wound formed the previous season. These galls perish in turn, and the process is repeated each season, resulting in a large, deep wound. When two or three galls are produced on different sides of the stem, it becomes so weakened that the tree breaks off at the injured joint.

Toumey has proved that the disease is of a contagious nature. Healthy seedlings planted in soil mixed with sliced galls contracted the disease, as did also healthy trees planted in proximity to diseased ones.

Since the investigations of Toumey were published, Messrs. Erwin F. Smith and E. V. Townsend have devoted a considerable amount of attention to the origin and cause of "crown-gall," and have come to the conclusion that the primary cause of these out-growths is a *Bacterium*, *B. tumefaciens*,

Crown Gall on Collar of Rose Stem.

a species not previously described, and that Toumey's Myxogaster is but a secondary agent. It seems quite certain that the galls investigated by Toumey and by Smith and Townsend are identical in origin. It is also quite certain that the "crown-galls" met with in England exhibit the *Dendrophagus* described by Toumey, and that in these no trace has yet been met with of *B. tumefaciens,* as described by Smith and Townsend in *Centralbl. f. Bakt. Parasit. u. Infektionskr.,* xx., p. 89 (1907).

From the economic standpoint, however, this variation in the experience of different workers does not materially affect the problem. It is not open to dispute that "crown-gall" is caused by the presence of a living organism. It is therefore possible to formulate definite preventive measures. Further, it is admitted by all who have investigated the subject that the affection, whatever its precise cause, is contagious. Nurserymen and fruit growers will on this account doubtless be glad to adopt such measures as are required to prevent the wholesale dispersion of the disease.

The disease is probably not new to this country, nor to other European countries, as descriptions of galls corresponding in appearance and position on the host-plant with "crown-gall" are described in works on plant pathology. Sorauer, who made some observations on such galls in Germany, noticed that they were much more frequent in some nurseries than in others, which indicated a parasitic origin, but not succeeding in finding the parasite, he considered such galls as probably the result of mechanical injury or some physiological disturbance. We have at present no knowledge of the relative frequency of "crown-gall" in this country. The galls are formed just underground, and thus escape observation, and those galls that have been observed from time to time have had their origin attributed to other than the true cause, and have not been considered as the symptom of a dangerous disease.

"Crown-gall" is most destructive to nursery stock, as the disease spreads rapidly along the rows, killing a large number of the seedlings outright. The widespread dissemination of the disease in the United States is attributed to the wholesale distribution of infected stock from nurseries,

X X 2

also to the carelessness of orchardists in not dealing promptly with diseased material. In the case of older trees becoming infected, the galls may continue to be produced for many years, the tree living on, but making less growth and producing less fruit, and of an inferior kind to that of a healthy tree. It is estimated that $1,000,000, possibly much more, are lost annually in the fruit-growing regions of the United States through this disease.

When trees are not badly diseased, Toumey found that by removing the galls and covering the wounds made with a paste composed of one part of sulphate of iron, two parts of sulphate of copper, and three parts of quick lime, the further development of the gall was frequently arrested. On the other hand, the most economical course is to remove and burn trees that are at all badly diseased, as they not only constitute centres of infection, from which the disease spreads rapidly through the soil to adjacent trees, but such trees, though they may continue to live for years, never produce a crop equal in either quantity or quality to that produced by a healthy tree.

Quick-lime should be worked into the soil in orchards known to be infected. Finally, nursery stock should be examined critically before it is planted.

PREVENTION OF DAMAGE TO HIDES, SKINS AND WOOL.

AMONG the most important live stock products, after the meat itself, are the hides of the cattle and the wool and skin of the sheep. They are, it is true, a bye-product in the sense that the animals are primarily grown for meat and not for their hides or skins, but they are a bye-product of very considerable value, and as such deserve more attention at the hands of farmers and others interested in the live stock industry than they commonly receive.

Their value can be largely increased or decreased by the manner in which they are treated, and this must directly affect the farmer as the producer of the raw material.

A deputation representing various trades connected with the hide and skin industry recently waited on Earl Carrington, the President of the Board of Agriculture and Fisheries, and

drew his attention to the importance and extent of the trade in these products, and especially to the depreciation in value arising from several causes. The points to which the attention of the Board were directed are discussed below.

The Warble Fly.—One of the most destructive insect pests in this country is the Warble Fly, which is injurious to the living animal, to the hide, and to the meat. Though the flies do not sting or pierce the skin, it is believed by some investigators that they have a peculiarly irritating effect on stock, and that when tormented by them, cattle will rush wildly about the fields in their endeavour to avoid the flies. Careful observations made in Ireland showed that cattle and particularly calves were extremely sensitive to the approach of the Warble Fly. In the case of fattening animals, this would occasion a loss of weight, while it would be still more injurious to cows by diminishing the supply of milk. With in-calf cows also loss may arise from this cause, simple abortion being the result of the excitement and exertion.

The maggots or bots living beneath the skin are also a source of irritation to the cattle, and by perforating the hide seriously damage it for tanning purposes. Thirdly, the meat round the wounds is frequently so altered by the inflammation set up that it is quite unfit for sale. When the hide is stripped from a carcass, the affected parts appear as straw-coloured, jelly-like patches on the surface of the meat. This is known in the trade as "licked beef," and it has to be entirely cut away, thus causing substantial loss, especially as it is usually found in the most expensive parts.

Various estimates have been made from time to time of the loss caused by the Warble Fly, but there are no reliable data on which an opinion can be formed. As an example of the comparative prevalence of the fly it may be mentioned that the Board were recently informed that in the case of a tannery where 132,000 hides were dealt with in one year, 40,000 of these were found to be damaged by Warble Fly, but in another case only 1,500 out of 20,000 were affected. The damaged hides were depreciated in value from 2*s.* 6*d.* to 5*s.* per hide.

A point of considerable importance to the tanning industry is that the warbles, when in an immature state, cannot easily

be observed in the hide, and this makes it difficult to fix a fair price.

Generally it may be said that this insect in its various stages must be the cause of a good deal of suffering which, from a humanitarian point of view, it is desirable should be diminished, while at the same time it must occasion a loss of condition in the cattle.

It is evident that any attempt to minimise the injury must be made by the farmer, and the Board would urge that every farmer who knows that his stock are troubled with Warble Flies should make a systematic attempt to eradicate the insects. There is good evidence to show that their numbers can be greatly reduced, and the united action of a number of farmers in a district might be expected to be productive of the best results.

The method suggested involves the frequent examination of the stock during winter and spring, especially from February to April, and the destruction of the maggots by hand.

The maggots, when "ripe," may be extracted by squeezing the warbles with both thumbs, and may then be squashed under foot. This is a better plan than covering the opening of the warble with grease or mercurial ointment, so as to suffocate the bot within. Alternatively a small amount of arsenic in solution may be inserted into the warble to destroy the maggot. The use of equal parts of Archangel tar and paraffin has also proved successful in Ireland as a means of destroying the warble under the skin. In the case of cattle treated with this mixture, all the warble maggots were found to be dead or shrivelled, and in many cases at least were being worked out of their holes, so that injury to the hide and flesh was reduced to a minimum, while the application did not appear to damage the animal's skin and hair. The mixture should be applied thoroughly at least twice in the season, about the middle or end of April and at the end of May.

If this practice is systematically followed, it must result in an appreciable reduction in the number of adult flies. Consequently fewer eggs will be laid to produce maggots in the following season. The method has been tested in the course

of some experiments carried out for the Irish Department of Agriculture and Technical Instruction by Professor G. H. Carpenter and Mr. J. W. Steen, and has resulted in a substantial reduction in the prevalence of the fly. In 1907, 2,090 maggots were squeezed out of 194 cattle on the farm where the investigation was being conducted, an average of 10·77 per beast. In the spring of 1908, 132 of these cattle were still on the farm, and had been left throughout the summer of 1907 without any kind of dressing or protection against the fly. From these cattle 586 maggots were squeezed out, an average of 4·44 per beast, and this reduction was thought to be due to the destruction in the previous year. In 1909, however, the proportion rose to 7·77, while in 1910 it was 7·52. The conclusion arrived at is that systematic maggot destruction in the spring will reduce the liability of the cattle to infection to a certain extent, but that the benefit will be limited until similar steps for the destruction of the maggots are taken on neighbouring farms. For this reason the cattle grazing on the outskirts of the farm suffered much more than those near the centre of the farm.

The Board would suggest that Agricultural Societies and Farmers' Clubs should urge their members to adopt this plan, which is certain in its results, and more effective than the use of strong-smelling dressings with the idea of deterring the flies from laying their eggs. The use of these dressings, though they have long been recommended, appears in the light of recent investigations to be of doubtful efficacy. As was stated in this *Journal* in November, 1906, p. 484, Professor Ostertag, the German authority, does not approve of the method, and said that no case was known to him where good results had been attained by it. Ostertag expressed the view that the only useful means of combating the warble fly is to extract the *immature* bots from the warbles and destroy them. This may be done, he says, by opening the warbles with a sharp knife and removing the bots; the scar in the hide will heal over smoothly and loss will not occur as is the case when the bots themselves drill the holes.

The Life History of the Warble Fly is described in Leaflet No. 21, but there are several points in this connection on which considerable uncertainty prevails, and the matter is at

present being investigated in the Board's Veterinary Laboratory.

Damage to Hides owing to Dirty Condition of Animals.—The value of the hides of cattle is materially affected by the uncleanly condition of the animals. Farmers, though they may recognise the importance of cleanliness in the case of dairy cows, seldom make any effort to keep fattening cattle clean, with the result that dung and dirt accumulate, particularly on the buttocks. This spoils the hair and makes the grain of the hide tender, with the result that the quality of the leather is depreciated. In addition it affects the cleanliness of the meat after slaughter.

It is desirable that fat stock should be groomed from time to time in order to encourage the growth of hair and preserve the condition of the hide.

Tar Branding of Sheep.—The practice of branding sheep with hot tar is one which frequently results in damage to the wool.

When the sheep are branded in the early stages of the growth of the fleece, the marking material, whether tar or pitch, becomes nearly worn off by the time the fleece comes to maturity, and no very appreciable harm is done to the wool. Flockmasters, however, frequently mark their sheep with tar and paint late in the season, and then when the wool comes into the hands of the wool-sorter, the tar and paint marks have to be clipped off. This enters into the calculations of the buyer, and a higher price is paid for clean fleeces. The Chairman of the Home Wool Buyers' Association estimated that the loss in this way is about 1 oz. per fleece, which represents a material item on a large quantity of wool.

It is therefore to the advantage of the farmer to see that the branding is done at an early stage in order to avoid depreciation in the fleece. The tar, if used at all, should be used very sparingly.

The Board have published a leaflet (No. 82) on the Preparation of Wool for the Market, in which this subject is dealt with as follows:—

"Where it can be avoided, tar should not be used for marking sheep. A large quantity of wool used for manu-

facturing purposes does not undergo the process of sorting, and thus it frequently happens that, in spite of efforts to remove tar-marks, some of the tar passes into the finished goods, thereby causing considerable damage and loss. Even when the wool is being sorted it is very difficult entirely to eliminate the tar.

"As tar is not dissolved in the ordinary processes of wool-washing, flockmasters should endeavour, in cases where its use cannot be avoided, to improve the methods of applying it, either by making use of smaller marks or by adopting means to prevent the tar from running. If practicable, marking on the ear or face is much to be preferred."

A serious matter in this connection is the risk that the iron and the tar with which the branding is done may be made too hot, and penetrate through the wool to the skin, causing severe suffering to the sheep, and at the same time destroying the value of the skin for tanning purposes. The inquiries which the Board have made lead them to believe that this only occurs in a limited number of cases through gross carelessness, but it is a point which farmers would do well to bear in mind.

In some districts of Scotland sheep are sometimes branded with a hot iron across the nose or cheek. This is a cruel practice which should be discontinued.

Efforts have been made to find a dye or other mixture which could be used in place of tar, but no satisfactory substitute, other than paint, has so far been discovered.

Injury to the Wool and Skins of Sheep by Various Parasites.—The injury due to the parasites causing sheep-scab is well known. In their endeavour to allay the irritation caused by the mite, the sheep constantly bite or rub the affected part, which results in an injury to the skin, followed by an exudation of serum and the formation of crusts or scabs. The wool is shed, and the fleece becomes broken and tufted or matted together, giving the animal a ragged appearance. With a view to the eradication of this disease the Board have made sheep-dipping compulsory, and with the earnest co-operation of all concerned there is reason to hope that their efforts will be successful in the course of a few years.

Several other sheep parasites, such as keds, ticks and lice, as well as the maggots of the sheep maggot-fly, also cause serious injury to the skin and wool in a somewhat similar way.

Broadly speaking, sheep dips are more or less effective against all these parasites. For the destruction of keds, two dippings at intervals of three weeks are necessary; for ticks arsenical dips appear to give the most satisfactory results; while any dip which is suitable for sheep scab is effective also against lice.

Full information as regards sheep-scab is given in Leaflet 61, while the general subject of sheep-dipping, both for sheep-scab and for the destruction of other parasites, is dealt with in Leaflet No. 145.

Dipping is also useful against the larvæ of the sheep maggot-fly, but is not permanently effective in preventing the flies from egg-laying or "striking." These maggots are the cause of much distress and suffering to the sheep, as well as of permanent injury to the wool and skin. The sheep consequently thrive badly, and the farmer loses by the depreciation in value both of the animal and of its fleece.

The measures recommended against this pest in Leaflet No. 126 are as follows:—

"(1.) *Cleanliness.*—Sheep should be kept thoroughly clean about their hind quarters. A good measure is to clip the wool of the tail and between the hind legs. The purpose is to clear away any filth and to give as little opportunity as possible for lodgment, for the flies have a keen sense of smell, and are attracted to dirty places for their egg laying. Hence it is that sheep suffering from diarrhœa are so often fly-struck.

"(2.) *Destruction of Carcasses.*—Carcasses of all dead animals, including birds, should be burned or buried so that they may not serve as breeding places for the fly.

"(3.) *Dipping.*—As a preventive measure dipping is useful, but as the effect of one dip does not last beyond a fortnight or so, the dipping must be repeated. Sulphur is regarded as an indispensable ingredient in any such treatment, the odour keeping away the fly. Carbolic dips are volatile and are valueless for this purpose.

"(4.) *Dressing.*—Dress the neighbourhood of wounds with

some deterrent dressing, *e.g.*, an ointment of butter and flowers of sulphur.

"Infested sheep should be isolated, and the maggots should be picked or rubbed off, or where they have got to work the wool may be shorn a little, the affected parts being dressed with a mixture of turpentine and rape oil in equal parts, or with dilute paraffin oil, finishing off with a dusting of sulphur."

In order to assist in the discovery of cases of sheep-scab, and indirectly of sheep attacked by maggots, the Deputation mentioned above suggested that the Board should recommend the appointment by County Councils of Patrol Shepherds, to assist the Police. The Board agree that Patrol Shepherds are very useful in wild and mountainous districts where sheep-scab exists, and where there is common grazing, but they could not suggest their employment in districts where sheep-scab does not exist, nor in the fenced areas which constitute the bulk of the agricultural land of the country.

Risk of Injury to Skins by Sheep Dips.—Complaints have been made to the Board that, with a view to the eradication of sheep-scab, farmers occasionally use sheep dips at a greater strength than is recommended, with the result that the solution causes suffering to the sheep and injury to the wool and skin. This is not likely to occur where approved dips are used at the proper strength, but the question how far dips are likely to affect the skin is being investigated in the Board's Veterinary Laboratory.

Experiments have shown that the use of strong arsenic or sulphur dips is attended with some danger when treating sheep affected with scab, especially if they are in low condition or have sores on them.

As regards the wool, the following advice on the selection of dips is given in Leaflet 82 (Preparation of Wool for Market):—

"In the selection of dips, care should be taken to use only those that do not permanently stain the wool, and dipping should not take place for some months before shearing.

"The results of experiments arranged by the Departmental Committee, appointed by the Board of Agriculture and Fisheries in April, 1903, to investigate and report upon the

dipping and treatment of sheep, go to show that tar acid (carbolic) dips, and tobacco and arsenical dips, with or without sulphur, when skilfully prepared, leave the wool in a nice condition. Fleeces so treated were placed in the first class by the Bradford Conditioning House, as not having deteriorated in value as a result of the dip. Pitch oil, spirits of tar, and crude tar products lowered the commercial value of the fleece by 5 or 10 per cent."

Flaying.—Another point to which the attention of the Board has been directed is the defective way in which the hides and skins are removed, with the resultant lowering of their value. This is a matter of interest to butchers rather than farmers, and the only way in which an improvement is likely to be effected would be through the action of some of the societies representing the industry.

In Ireland a number of demonstrations of the most approved methods of flaying hides and skins were given in 1908–9 by an expert flayer at the principal centres of the fresh meat trade and of the tanning industry in Ireland. The work was carried out through the co-operation of the Irish Tanners' Federation, who undertook, subject to the approval of the Irish Department of Agriculture, to employ a properly qualified flayer, to select the centres and to organise the demonstrations, the Department itself defraying the expenses. A similar series of demonstrations was given in 1905–6, and it is stated that the instruction was much appreciated, and that a lasting improvement in the methods of flaying is anticipated.

At Glasgow and at Newcastle the trade societies have endeavoured to some extent to encourage the men to become more skilled in flaying by offering prizes for proficiency, and this is said to have had satisfactory results.

In this connection complaints have been made of the inefficient way in which sheep are commonly skinned. It is stated that it is difficult to obtain a sufficient number of well-flayed sheep skins in Great Britain, and that in consequence buyers have to obtain them from France and other parts of the Continent, where much more care seems to be taken.

SALE OF LOW-QUALITY MANURES AT EXCESSIVE PRICES.

The attention of the Board of Agriculture and Fisheries has been drawn to the sale as manures in different parts of the country of substances which are practically worthless as fertilisers, and to the sale of manures of low quality, which are offered at prices far above their real value.

The vendors of these substances generally give in their advertisements and invoices a correct analysis of the constituents, and appear to expect that lack of knowledge on the part of the purchasers will prevent them from appreciating the true value of the substance as indicated by the analysis.

For instance, a manure (1) offered at £3 10*s*. per ton, and described as "a complete fertiliser in the cheapest form," is stated to contain the following constituents:—Nitrogen, 1·23 per cent.; soluble phosphates, 5·0 per cent.; insoluble phosphates, 1·50 per cent. Three other manures offered at the same price contained respectively, according to the invoices, the following constituents:—(2) Nitrogen, 1·15 (equal to ammonia, 1·40), and phosphates, 7·0; (3) nitrogen equal to ammonia, 1·40, and phosphates, 8·0; (4) nitrogen, 1·0 to 1·25, and phosphates, 6·0 to 7·0.

It may be pointed out that the quantities of nitrogen and phosphates in the four manures referred to could have been purchased in nitrate of soda, superphosphate of lime, and basic slag, on the basis of the unit values * given this year in the revised edition of the Board's Leaflet No. 72 (*The Purchase of Artificial Manures*, at the following cost respectively:—

			s.	d.		s.	d.	
(1)	Nitrogen 1·23	=	14	3				
	Sol. phosphates 5·0 ...	=	10	0	=	26	0	
	Insol. phosphates 1·5 ...	=	1	9				
(2)	Nitrogen 1·15	=	13	4	=	21	6	
	Phosphates 7·0	=	8	2				
(3)	Nitrogen = Ammonia 1·4	=	13	4	=	22	8	
	Phosphates 8·0	=	9	4				
(4)	Nitrogen 1 to 1·25 = 11s. 7d.	to	14	6	=	18	7	to
	Phosphates 6 to 7 = 7s.	,,	8	2		22	8	

The manures would only be worth these prices if manufactured of first-rate materials like nitrate of soda, superphos-

* Nitrogen in nitrate of soda, 11s. 7½d. per unit; soluble phosphates in superphosphate, 2s. per unit, and insoluble phosphates in basic slag, 1s. 2d. per unit.

phate, and basic slag. Nitrogen may, however, be purchased in cheap forms in organic substances (see Leaflet No. 175, *Waste Organic Substances as Manures*), while insoluble phosphates can be purchased in the form of ground rock phosphates at little more than half the sum they cost in basic slag. Assuming the nitrogen to have been derived from a low-grade shoddy and the phosphates from rock phosphates, the manures could have been compounded at the following cost respectively* :—

			s. d.		s. d.
(1)	Nitrogen 1·23	=	7 4		
	Sol. phosphates 5·0 ...	=	10 0	=	18 5
	Insol. phosphates 1·5 ...	=	1 1		
(2)	Nitrogen 1·15	=	6 11	=	12 2
	Phosphates 7·0	=	5 3		
(3)	Nitrogen = Ammonia 1·4	=	6 11	=	12 11
	Phosphates 8·0	=	6 0		
(4)	Nitrogen 1 to 1·25 ...	=	6s. to 7 6	=	10 6 to
	Phosphates 6 to 7 ...	=	4s. 6d. to 5 3		12 9

These figures, it will be seen, vary from 10*s*. 6*d*. to 18*s*. 6*d*. It would indeed be possible to indicate even cheaper materials than those mentioned above, from which "manures" having the composition of (2), (3), and (4) might be prepared, materials which it would not pay the farmer to apply if he got them for nothing!

The loss to the farmer, however, does not lie merely in the fact that he pays £3 10*s*. for something which at most is only worth 19*s*. to 26*s*., and may be worth no more than 10*s*. 6*d*. to 18*s*. 5*d*. A much more serious loss arises from the fact that the fertilising value of the manure is so low that it may be quite ineffective for the purpose in view.

In a recent action in Scotland, where a farmer purchased a manure, relying on the skill and judgment of the seller, and the manure was found to be not reasonably fit for the purpose for which it was purchased, it was held that the purchaser was not liable to pay the price of the manure, and damages were awarded him for loss due to failure of the crop.

Buyers should not be misled by suggestions that compound manures have a value which is not indicated by the analysis. For example, it is frequently claimed by the sellers of such

* The unit values being:—Nitrogen in shoddy, 6s.; phosphates in rock phosphates, 9d.

manures that the nitrogen they contain is of "animal origin" or "derived from organic matter," and on that account possesses some superior value. Assertions are also frequently made as to the "large proportion of ammonia" they contain, though it is evident from the analysis given that the content of ammonia is really very low.

A complete explanation of the method of valuing artificial manures so as to ascertain their true commercial value is given in Leaflet 72, referred to above, and farmers should consult this leaflet in order to see whether the price of the manure, having regard to cost of carriage and terms of payment, is approximately equal to the value of the fertilising constituents which the manure is stated to contain. When wide discrepancies are disclosed, no purchase should be made; the chances are that the manure would be dear at any price.

Apart from lime, which may be purchased at from 10*s.* to 18*s.* per ton in most localities, there are three constituents, and only three, which should be taken into consideration in arriving at the value of artificial manures, viz., nitrogen, phosphates, and potash. These are the constituents which an artificial manure is intended to supply to the crop, and any statements as to its value in other directions should be ignored.

THE CULTIVATION OF FIELD BEANS.

EDRIC DRUCE.

Agricultural Institute, Ridgmont, Beds.

THOUGH this crop is as well known to the general public as any farm crop, the acreage is, comparatively speaking, very small. In 1910, the total for Great Britain was 270,000 acres, a decrease on 1909 of nearly 44,000 acres, and in an average year there are throughout England only 2·6 acres of bean for every 100 acres of ploughed land. The relative extent to which the crop is cultivated will be seen from the following table relating to the acreage in 1909:—

County.	Acres of Beans per 100 Acres Arable.	County.	Acres of Beans per 100 Acres Arable.
Bedfordshire	8·6	Buckinghamshire ...	5·3
Huntingdonshire ...	7·9	Oxfordshire	3·7
Suffolk	7·4	Hertfordshire	3·7
Essex	6·6	Middlesex	2·5
Northamptonshire ...	6·4	Rutland	2·4
Cambridgeshire	5·7	Nottinghamshire ...	2·3
Warwickshire	5·7	Leicestershire	1·9

It will be seen that even in Bedfordshire, Huntingdonshire and Suffolk, the highest upon the list, the acreage is not very large.

The bean, being a leguminous plant, naturally takes the place to a certain extent of clover, and being under certain conditions a cleaning crop, it can replace a fallow, but it is a better plan to ignore the latter possibility and consider it only as a leguminous crop. It is not suited to the lighter soils and is grown almost exclusively upon clays and the heavier loams, particularly those which contain an appreciable amount of lime. It is to this cause that the limitation of the acreage is due.

In many districts where beans are grown, red clover seed is also a common crop. Experience has shown that, if the land is farmed upon the standard four course rotation, the red clover will not be successful every fourth year, but will produce a good crop when grown at eight year intervals. In this way an eight course rotation has originated, in which beans replace red clover. In this rotation during the eight years there are four white straw crops, two fallows, and two leguminous crops.

Varieties.—The varieties, especially seedsmen's varieties, are not at all numerous, and can be divided into two main classes, namely, winter and spring. There are more kinds of the latter than the former, the chief being the Black Eyed, the White Eyed, the Heligoland, the Mazagan, the Teck, the Cluster, and the Red. There is a very large amount of purely local prejudice in favour of the different kinds, but in experiments at Ridgmont the Red Spring variety has produced the most profitable results on a typical bean soil. Change of seed from a different district in England produces a very slight increase, if any, over home-grown seed. Seed from similar soils in Lincolnshire, Essex, Suffolk, Buckinghamshire, Oxfordshire and other counties has been used to compare with home-grown Bedfordshire seed, but the results did not show definitely that the seed from any one district was to any noticeable extent preferable to that which was home-grown. At the same time it is probably advisable to obtain a change of seed periodically, and to get it from a different class of soil. Seed from a light loam or chalky soil makes a very good change on to the heavy clay.

Cultivation.—Coming between two white straw crops, the cultivation will to a certain degree be that of a fallow crop, and thus it will vary to a considerable extent in different districts. With winter beans the more generally accepted practice is to give the land a light dressing of farmyard manure, some 8 to 10 tons per acre, which is drawn on to the stubble and spread as soon as possible after harvest. This is ploughed in to a medium depth, say 5 to 6 inches. After harrowing the seed is drilled at the rate of 2 to 2½ bushels per acre, in rows some 20 to 22 inches apart. The earlier the crop can be sown the better, and if it is impossible to sow before the end of October, the better plan is to wait until later in the season and sow a spring variety. During a wet autumn beans may be ploughed in; this practice consists in fixing a small hopper on the plough, dropping the seeds just in front of the mould boards, thus covering the seed, which is planted along each alternate furrow, the land being subsequently harrowed. By this means the ground is not trampled by the horses to any great extent.

In bygone days it was the custom to dibble beans, especially on heavy, poorly drained soils, and in certain districts this custom still lingers; except for the question of expense it is a highly satisfactory method of sowing. The custom was for the man doing the work, having set two lines about 20 inches apart as guides, to walk backwards across the field with a long-handled dibber in each hand making holes every eight or nine inches; two boys followed him, dropping two or three beans in each hole; on reaching the far side he shifted the lines and walked back kicking in the seed holes; a good man with two boys could do one and a half acres in a day.

With spring beans the land usually receives a similar dressing of farmyard manure, but the work can be done as opportunity occurs, so long as the land is ploughed up by about the end of the old year, that is, in time to allow the frost to act upon it. No further cultivation is needed until just before sowing, which should be done as early as possible after the beginning of February. The mechanical condition of the land should be taken as a guide, for the soil should be dry and friable, so that the seed can be drilled a fair depth and well covered. Some growers prefer to postpone

sowing until a month later, so that there is less danger of the young plants being injured by a late frost, but, taking all things into consideration, the early sowing is the best, because the early sown crops are less liable to be ruined by the bean aphis, while in the case of a heavy clay soil an opportunity of sowing under first-rate conditions will probably not occur twice in one season.

Spring beans are drilled at about 21 inches apart, using three bushels of seed, except with the Cluster variety, which is sown at 10 to 12 inches apart. From repeated observation it is found that this narrower distance gives a larger yield, and many good farmers go a step farther and drill all the spring varieties at this short distance apart; but this prevents the land being horse hoed, except with a corn horse hoe, and it is found in practice that this excellent implement does not do good work on heavy soils with narrow, high-backed "lands." The followers of the close row method argue that beans coming only two years after a fallow shift in the rotation should not require horse hoeing; theoretically this may be true, but it must be remembered that not infrequently the weather does not permit the fallows to be thoroughly cleaned; under such circumstances, for the sake, not only of the beans themselves, but also of the wheat following, it is essential that every effort should be made to keep the land as clean as possible. The horse hoeing should begin early, and it is very beneficial to use plain curved tines similar in shape to those on a steam cultivator, instead of the ordinary duck-foot and L-shaped hoes for the first hoeing; a second, and occasionally a third, hoeing is given, using the ordinary hoes. Between the first and second horse hoeing the crop should be hand hoed. In this way the land is kept as clean as the weather will permit.

Manures.—Beans respond well to an application of farm-yard manure, but do not as a general rule give a profitable return when "artificials" are used. Being leguminous plants we should not expect them to respond to a nitrogenous dressing, nor are good results obtained, in the vast majority of cases, from either phosphatic or potassic manures. The late Mr. James Mason, of Eynsham Hall, Oxon, did however, get excellent results from an application of 5 cwt.

basic slag and 5 cwt. kainit per acre, upon some stiff clay soils in that district. This has been borne out by trials at Cockle Park in 1907, when basic slag by itself and also in conjunction with muriate of potash, produced quite satisfactory results. In the rotation experiment at Saxmundham, where beans alternate with red clover every fourth year, the farmyard manure plot is distinctly the best, whilst a phosphatic and potassic dressing, viz., 2 cwt. of superphosphate and 1 cwt. of muriate of potash, also produces excellent results; it is most marked at this centre that the application of nitrate of soda is practically useless.

Harvesting is easier than in the case of white straw crops, because the same degree of dryness is not required. The crop is cut when the leaf has fallen and the lower pods are blackened; the cutting can be done with the binder in the majority of cases, but occasionally when the straw is very short and the lowermost pods are close to the ground, the cutting must be done either with a reaper or by hand. When using a binder it is advisable not to use new knives or canvases.

Either eight or ten sheaves are placed in each shock, and the carrying should not take place for a week or ten days, when, under favourable conditions, the straw will be sufficiently dry and seasoned. The carrying should be done on a dull day or early in the morning before the dew has disappeared; if done when the sun is shining brightly the pods may split open and a considerable amount of the grain be shed. It is a great advantage, if possible, to have some beans and oats ready to cart at the same time, so that a beginning can be made in the early morning with the beans, and when the sun is fully up and bright the work may be transferred into the oat field.

Rectangular ricks some four to six yards wide are usually built. The stubbles give a very good picking for the ewe flock, and if the crop has been podded low on to the ground or a considerable amount of grain has been shed, it is a good practice to turn out some store pigs to work over the stubble and glean what would otherwise be lost.

Thrashing for seed corn is of importance when the grain is hard and dry; it is essential that the drum be set fairly

wide, otherwise a large number of grains will be split; when the beans are required for consumption this splitting is rather an advantage than otherwise, because it shows that the grain is sufficiently dry and hard to grind well.

Old beans are a better and more economical food than new ones, and it is therefore advisable to postpone the thrashing of the main bulk of the crop until March at the earliest, and for preference until the rick has been standing at least twelve months. Beans are a most useful food upon the farm, as when used with judgment they are suitable for all classes of stock, which cannot be said of any other individual feeding stuff. It is better to mix the beans with other concentrated foods, particularly with oats. If large quantities of bean-meal are given to milch cows it has a great tendency to prevent the cream from churning in a satisfactory manner, and though a few whole beans are very useful when given to growing store pigs, the use of large quantities of bean-meal when fattening them is unsatisfactory, because it will make the lean meat hard, and the bacon when cured will not be of the highest quality. Bean cavings make an extremely good fodder for horses and sheep, but it is not advisable to use the straw for this purpose, as it is likely to cause stomachic troubles.

The chief enemy of the bean crop is the aphis, which attacks the leaders of the plants early in the summer, greatly lessens the yield, and in many cases ruins the crop. When a bad attack occurs there is no cure, but the best preventive is to have the plants in a strong, vigorous condition, to obtain which early sowing on land in good heart and well tilled is the only sure method.

INTERNATIONAL FORESTRY CONGRESS AT BRUSSELS.

THE Sixth Congress of the *Union Internationale des Stations de Recherches Forestières* was held at Brussels from September 10th to 20th last. The meeting was attended by delegates from all parts of Europe, from the United States and Canada, and from Japan. Among the representatives from Great Britain were Prof. Schlich and Prof. Somerville, Oxford University; Mr. Pratt, President of the Royal Eng-

lish Arboricultural Society; and Mr. R. L. Robinson of the Board of Agriculture. The Belgian Government voted a sum of £360 towards the entertainment of the guests, and the Forest Service went to an immense amount of trouble in making arrangements for the various excursions and in providing for the comfort of the visitors.

The Association aims at the development of forestry research, the exchange of views between the research stations in various parts of the world, the standardisation of methods of research so as to render possible a comparison of results and the promotion of the study of questions of general interest. The matter of a forestry bibliography is also under consideration.

In addition to a series of meetings, visits were paid to some of the chief types of forests in Belgium. The first day's excursion included a visit to the Hertogenwald, a State forest of some 16,000 acres lying at an elevation of 700 ft. to 2,150 ft. in the extreme east of Belgium. The conditions resemble those in the more mountainous districts of Britain, and for that reason the work being carried on there is of considerable interest to British foresters.

Here (Hautes Fagnes), at an altitude of 2,000 feet, the Belgian Government are attempting to afforest a moor. The underlying rocks are Cambrian phyllites and quartzites, and the soil for the most part is an impermeable clay covered with peat to a depth of from 1–3 ft. The experience of the Belgian foresters is that the spruce alone is of any use for such situations, and the use of all other species has been abandoned. The method of planting is that known in this country as the Belgian system. The soil is first drained by ditches approximately 13 feet apart, 2 feet wide by 10 inches deep. The material from the drains is taken out in blocks, which are all placed face downwards alternately to the right and left of the drain. In each of these blocks a hole is cut with a conical planting spade, a little earth containing some fertiliser inserted in the hole, a young spruce plant (2 year 2 year) placed in position, and the conical piece of turf previously removed broken up and pressed round the roots. The cost of planting 1,340 plants per acre, draining, etc., is given as £3 14*s*. per acre. The actual planting is done by women.

Experiments have been carried out to determine the best

fertiliser to use in this connection. In a plantation made in 1904 the best trees were those fertilised with a mixture of cinders and basic phosphate, closely followed by those fertilised with a mixture of chalk and earth. The unfertilised trees were yellow and sickly and reduced to half their former numbers. Further experiments were also being carried out to determine the best system of drainage. The general opinion among the delegates was that the chance of getting a paying crop in the face of such difficulties was remote. The theory of the use of fertilisers in planting is that the young trees are given a start to enable them to form a canopy over the ground. From this point onwards the further formation of turf ceases, owing to the dying off of mosses, the peat shrinks considerably and the young plants are enabled to get their roots into the mineral soil below. As the Belgians express it, "the spruce eats the peat up." There is, therefore, a great probability that the second crop of spruce will do considerably better than the first. The maximum depth of peat which could be thus planted was held by many to be about 3 feet.

There was evidence in the neighbouring woods that even in the exposed positions the spruce thrives very well when the peat is only a few inches deep. A 48-year old wood, at 1,800 feet elevation, in which a thinning experiment was being conducted, showed a volume of 4,500 cubic feet quarter girth. A Scotch pine plot at an elevation of 1,460 feet, used for a similar purpose, showed at an age of 103 years a volume of only 3,450 cubic feet quarter girth. The superiority of spruce for mountain planting was obvious. An interesting plantation at this point was a crop of *Picea rubra* aged 58 years. The volume worked out at 3,400 cubic feet quarter girth, which is not as good a return as a crop of Norway spruce would give under the same conditions. A clump of *Pinus rigida* aged 61 years had a mean height of 35 feet. The trees were poor specimens.

In the district of La Campine in the north-east of the country, the Forest Department is carrying out a series of experiments and afforestation works. The country consists essentially of a sandy plain at an elevation of 170 feet to 350 feet, with here and there sand dunes, both moving and fixed. The soil is very poor, especially in lime, nitrogen, and

phosphoric acid; the presence of an impermeable pan causes the water to collect into pools in the lower parts in winter, while the climate generally is unfavourable. Scotch pine is the chief species grown—a few plantations only of maritime pine have survived the cold winter of 1890–91. Corsican pine is being used in some of the new plantations.

The slow-grown coniferous wood of this district is in great demand for pit timber, and the best plantations under a rotation of 40–45 years give a yield of as much as £56 per acre, though containing at most 2,100 cubic feet quarter girth (6·4*d.* per cubic foot). In the forest of Pijnven the following methods of afforestation are being followed:—

(*a*) On the stable dunes: The soil is worked up with the spade in bands 13 inches wide. The bands are 2 feet 2 inches apart. Cost, 13*s.* per acre.

(*b*) On moving dunes: Breaking up of pan where necessary. Fixation of the dunes. Cost, 16*s.* to 25*s.* per acre.

(*c*) In the low parts: Drainage and breaking up of the pan with spades. Cost, £4 7*s.* 6*d.* per acre.

(*d*) On heaths where there is no pan: Ploughing of soil to a depth of 8–10 inches. Cost, £1 per acre.

(*e*) On heaths with a shallow pan: Ploughing to a depth of 12–14 inches. Breaking up of sub-soil to a depth of 18 inches. Cost, £2 per acre.

(*f*) Occasionally where the pan is at a considerable depth it is broken up with the spade only. Cost varies from £3 to £8 per acre.

Fertilisers.—Application of kainit and phosphates. The whole of the kainit and half the phosphate is applied before the soil is worked, and the rest of the phosphate afterwards. Cost, £1 12*s.* per acre.

Lupin.—Part of the land has been afforested without the preliminary use of lupins. Since 1906 lupins have been cultivated for 1–2 years, and then dug into the soil previously to planting trees.

Plantations: Conifers.—One year seedlings of *Pinus sylvestris* with a small proportion of Corsican and Maritime pines are used as a rule, but on the dunes 2 year transplants; 4,500 plants per acre are used.

The blanks are filled up with Corsican and Maritime pines.

Along the fire-guards, and in the lower damp parts where conifers do poorly, broad-leaf trees such as *Quercus robur, Q. rubra, Alnus incana* and *A. verrucosa, Betula alba* and *B. papyrifera, Robinia pseudacacia, Prunus serotina,* &c., have been planted.

Experiments are being carried on to determine the best mixtures of *Pinus sylvestris, laricio, pinaster,* and *rigida*. The question of the exact effect of the action of fertilisers in the dunes is also receiving attention.

The third excursion lay in the forest of St. Michel and the Fays de Lucy. Starting from St. Hubert, in the Ardennes, at an altitude of about 1,450 feet, the road ascended gradually to about 1,800 feet. The woods of the district are composed for the most part of beech with some oak and sycamore. The soil is the decomposition product of Devonian shales. Between the stretches of broad-leaf woods lie considerable areas of bog. A start has been made to drain these and to plant them up with spruce. Beech shows good growth even in the most exposed places, so long as the soil is free from much peat, but at the same time nothing like the volume can be obtained from this species as from spruce. This is brought out from the following official measurement of experimental plots :—

Elevation.	Species.	Age.	Volume quarter girth.	Soil.
Feet.			Cu. ft.	
1,770	Beech	160	2,500	Loam, poor.
,,	,,	140	2,840	,, ,,
,,	,,	87	4,260	Deep loam.
1,720	Spruce	56	6,670	Peat formerly 2 feet deep.
,,	,,	43	4,330	,, ,, ,, ,,
,,	,,	43	4,500	,, ,, ,, ,,
,,	,,	43	3,800	,, ,, ,, ,,
1,700	,,	37	3,600	Peaty loam.
,,	,,	37	3,160	,, ,,

On the other hand, Scotch pine woods growing at considerably lower altitudes were very poor, and showed no promise whatever of developing into a crop of any value.

A number of experiments is being undertaken in these forests to determine the best methods of thinning spruce crops, and to determine the rate of growth of spruce timber.

Perhaps the most interesting expedition was that through

the Forêt de Soignes. This forest, which is a remnant of the ancient Forêt Charbonnière, is one of the finest beech forests in the world. It lies to the south of Brussels, and stretches from the gates of the city almost to the field of Waterloo. A particular interest attaches to the forest in that until recently the beech has been regenerated by artificial plantations. The excellence of the growth is accounted for by the mild climatic conditions and the fertile nature of the soil, which is a sandy-clay.

Until 1886 the forest was worked under a system of clear-cutting with replanting. At the present time it is managed in several series:—

(*a*) An artistic series of some 4,500 acres in the neighbourhood of the city worked on a modification of the Selection System. This is, in fact, a splendid park for the use of the citizens of Brussels.

(*b*) A series of 1,850 acres worked on the Shelterwood Compartment System, with a rotation of 160 years.

(*c*) A series of 1,980 acres on a clear-cutting system.

(*d*) Coppice with standards in process of conversion into high forest, 800 acres.

(*e*) 690 acres of coniferous wood, in which an attempt is being made to bring in an underwood of broad-leaf species.

The following table gives some of the official figures with regard to the volumes per acre. They are taken from the accounts of the numerous thinning experiments which are being carried out by the forest officers in this forest:—

Age.	No. trees per acre.	Vol. quarter girth per acre	Soil.	Remarks.
		Cb. ft.		
44	740	2,430	Sandy loam	Unthinned.
44	500	2,250		Light thinning.
44	460	2,335		Moderate thinning.
67	175	3,860		Experiments to determine effect of humus on rate of growth.
67	238	4,720		
67	203	4,300		
119	85	4,725	Rather poor conditions	
148	81	7,010	Excellent.	

The height of the best trees in the 148-year old crop above was not less than 115 feet. Quite an extensive thinning series has been started during the last four years, to deter-

mine the system most favourable to the growth of beech. These have been divided into seven lots, as follows:—

(1) Check plot.

(2) Light thinning, removing only the trees which are entirely dominated or dying. (Fifth class.)

(3) Moderate thinning, removing the dominated trees and the whips which are reaching up to the crowns of the dominants. (Fourth and fifth classes.)

(4) Moderate thinning, leaving the dominated trees, but removing the whips. (Fourth class.)

(5) Heavy thinning, cutting out the dominant and also the smaller dominated trees. (Third, fourth, and fifth classes.)

(6) Heavy thinning, cutting out the dominant, but leaving the smaller dominated trees.

(7) Special thinning, cutting out only those trees interfering with the trees which are to form the final crop.

In another part of the forest experiments are being carried on in a 67-year old wood, to determine the effect of fertilisers on the growth of beech. In some cases the humus layer has been removed, in others the leaves turned into the soil, and in yet others applications made of basic phosphate and kainit. No results have yet been obtained. The result of an interesting experiment to show the use of harrowing the ground beneath beech to produce a crop of seedlings was shown. On one plot the ground beneath a 119-year old crop had been harrowed with a Danish type of rotary harrow two years previously, and on another the soil had been left in its natural condition. Whereas in the former case there was a dense crop of seedlings on the ground, in the latter they appeared only in small numbers here and there. The addition of lime to the soil seemed to have little or no effect in improving the germination.

An interesting experiment is also being carried out on an area which had been clear-cut and allowed to lie exposed to wind and sun, so that the soil had deteriorated.

The method of establishing a new plantation has been to bring in oak, ash and sycamore in conjunction with fast-growing species, such as grey alder. The plantation was made in 1906, so that it is too early yet to judge of the success of the method. Two points of interest to the British forester

were the presence of the felted beech coccus (*Cryptococcus fagi*) throughout the wood, and of the large larch saw-fly (*Nematus erichsoni*). Although beech coccus could be detected on most of the trees, it was seldom very bad, and is not taken seriously by the Belgian foresters. The occurrence of the larch saw-fly is somewhat remarkable. The larch is found only in small scattered groups in Belgium, and flourishes nowhere, yet it was possible to find signs of the presence of the insect almost everywhere.

The visit to the Arboretum at Groenendael in the neighbourhood of Brussels was spoiled by incessant rain. Almost every exotic tree which was at all likely to succeed under the climatic conditions has been planted in small "boquets" under forest conditions.

The Belgian Forest Service is extremely energetic and well organised. Numerous experiments have been started during the last few years to determine the best methods of thinning and regenerating woods, and of bringing new plantations on to ground which has been bare for considerable periods. The question of manuring poor soils has also been taken up very strongly.

It is proposed to give a summary of some of the more important papers read at the Congress in future numbers of this Journal.

CO-OPERATIVE LIVE STOCK INSURANCE.

E. A. STOPFORD.

Irish Agricultural Organisation Society.

THE insurance of live stock by groups of farmers with their own money, and under their own management, has often been started and worked in various countries, but until recent years it showed no tendency to spread, but rather to flicker and die out. Agricultural co-operation has, however, taught small farmers in many countries the benefit to themselves and to their neighbours of union and fellowship, and organised mutual self-help is now recognised as a principle of success in farming. When farmers on the Continent began to organise themselves into co-operative syndicates, it was not long before the invaluable benefits of cattle insurance

seized upon their imagination, and in a few years unions were formed which grouped as many as 60 societies with 6,000 members, and insured cattle to the value of £250,000.

It is to the small farmer that the insurance of cattle is of especial benefit. The three-cow farmer, when he loses an animal, no longer remains a two-cow farmer for the rest of his life; while the farmer who, to avoid the risk of loss of all his capital at one blow, bought two low-priced cows, can now buy a valuable one. This is said to have done more to improve the breed of cattle than many other measures adopted for that purpose. At the same time the payment of rent is rendered much more regular and secure, and the profits of the small farmer much less precarious.

It is not proposed in this article to enumerate all the minute details and rules so vital to good management, but rather to describe the general plan of the whole scheme, its principles and its administration, for the encouragement, instruction, and guidance of any who may desire to induce bodies of farmers to organise themselves for the purpose.

In order to show the wide range of the varieties of co-operative live stock insurance in actual work in various countries, we may, before taking up an example of an elaborate insurance society, describe an association based almost entirely on the good-will and good fellowship of the farmers.

Certain farmers, in the year 1879, formed a society in La Vendée, France, called "La Fraternelle." They had their cattle valued, and in due time held their half-yearly meeting. Their plan was to calculate the loss for six months and divide it by the value of the cattle insured, and thus arrive at the percentage. The president announced the result, let us say 1 per cent., and called over the roll. "A, you have cattle insured value £10; you owe 2*s*. B, your cattle are £20; you owe 4*s*." And so on. The farmers then walked past the president's table, each one laying down his assessment, and when all had passed, there lay on the table the exact amount of the losses. Those who had lost cattle were then called up one by one, and the president, reading out the amount due to each, handed it to him. That was all. No cash accounts, no book-keeping. All was done on the spot and under the eyes of the members, and all departed content. It added to its scheme a simple precaution against

disastrous seasons. At each half-yearly meeting each member brought an additional sum of one-tenth per cent., or $2\frac{1}{2}d.$, for every £10 of the value of his insured cattle, and this was laid by against emergencies. Their union in ten years had 64 societies affiliated to it, with 11,000 members and £360,000 worth of cattle insured, and it is still at work and giving satisfaction.

A more scientific scheme in very extensive use abroad may now be described. It takes into account not only the risks of life, but the shortcomings of human nature, and recognises that, even among co-operating farmers, frauds or attempts at fraud may occur and must be guarded against. The fundamental principles are these:—

1. The local society must be limited to a small area, where the neighbours all know each other, and exercise an unconscious supervision over each other.

2. The farmer must declare all the cattle he possesses, as well as those he actually wants to insure.

3. An examination and valuation must be made of all the cattle, whether proposed for insurance or not. This is done by appointed valuers, who are farmers elected for the purpose, and must be members and must be insured.

4. The indemnity must never be more than 80 per cent. of the value; the owner must take at least 20 per cent. of the risk to ensure fair dealing.

5. The local societies must affiliate with the central union, and must re-insure with it a portion of their total risks (say $\frac{1}{2}$ or $\frac{1}{4}$), handing over to it the same proportion of their total premiums.

6. Each local society elects a committee—a president and secretary are appointed; the secretary may be paid; all others give their services gratuitously.

7. The local societies are autonomous; each society can make its own modifications in the rules (which are drawn up by the central union), provided such modifications meet the approval of the central union and the Registrar.

8. A member must join for one complete working year in addition to any fraction of a year. Cattle under three months and over twelve years are not eligible. The rate of mortality on the average in many countries on the Continent is found to be 2 per cent.

The premiums must be calculated at a figure which will cover a greater rate than the average, and until there is a reserve fund they should be sufficient to provide for losses up to $3\frac{1}{2}$ or 4 per cent., or sufficient to cover the average 2 per cent. loss, with power to make further levies up to a fixed maximum when losses are great. In various countries of Europe a premium of $1\frac{1}{4}$ to $1\frac{1}{2}$ per cent. is found sufficient over wide areas, almost all work being done gratuitously, and certain small subventions being given by the State. When a reserve fund has been accumulated, the rate of premium can be reduced by a vote of the general annual meeting. A proportionate entrance fee is often charged after a reserve fund has been made. These rates apply to cattle. The rates for horses are double. For sheep and pigs it appears that insurance has not so far been successful, and one meets with warnings that they are very dangerous risks to touch.

Each society should engage a paid expert to deal with the carcasses of slaughtered animals for the abattoir or otherwise. When illness or accident occurs, the owner must at once summon the two appointed valuers nearest to him, and with them consult what steps should be taken, and whether a veterinary surgeon should be called in, and whether the animal should be slaughtered. There arise cases in which timely slaughter is recommended while the animal is in good condition, rather than that a long illness, loss of condition, fees to veterinary surgeon, and cost of medicines should be suffered. The owner must agree to such a decision or forfeit his indemnity. In such cases he is sometimes given an advantage, as this slaughter may benefit the society. In a certain society where 25,000 cows were insured the 500 carcasses realised £1,500, an important factor in keeping premiums moderate.

To guard against fraud, the best safeguard is found to be a valuation of all cattle twice a year. This also provides for fluctuation of value at different seasons. The owner and two valuers make these assessments of value. The plan is found to give rise to no trouble. The owner does not wish to raise his premium by naming too high a price; the valuers do not fix inordinately high prices to obtain large premiums, because high assessments would entail high indemnities. If the three men differ in their assessment, the average of their three

valuations is taken. These valuers may be paid by the committee or not, as it thinks fit to decide.

The cattle insured are marked on the ear or on the hoof, which marks, as well as a description of the age, sex, breed, colour, &c., are entered in the register. No animals held for the purpose of dealing are eligible. There are simple regulations for placing on the register the substitutes of any cows sold. Indemnities are paid within a week or two after the loss.

The societies are not responsible beyond their resources. Societies without capital cannot meet epidemics. In such emergencies societies may vote that they will (*a*) pay a smaller indemnity, (*b*) vote an extra levy, (*c*) postpone the indemnity until better times, (*d*) seek a loan from the central re-insuring union. Certain losses are specified as not to be indemnified. These are casualties by war, riots, theft, pillage, inundations, fire, lightning, fall of buildings, transport by road, rail, or water, and also losses caused by want of care, by bad or violent treatment by the owner, or by persons for whom he is legally responsible. Animals on the way to or from a fair or a show remain covered by the insurance. If the loss is caused by another party, the owner is bound to take his recourse against that party before claiming his indemnity.

The details necessary for the successful management of this insurance may seem very complicated for a local society of small farmers, but experience of co-operative work shows that this type of insurance will give no more trouble than many other branches of co-operative work, and is, in fact, extremely simple.

Central Re-insuring Union.—For re-insurance, the Union of the local societies is formed at the central headquarters, generally under the auspices of a large agricultural co-operative federation. The administrative committee for re-insurance consists of a certain number of members appointed by that federation out of its own members or out of its own committee, and the affiliated societies elect also a certain number of representatives to sit on the committee, the societies forming themselves into groups for the purpose of election. Six affiliated societies fairly distributed in different parts of the

country, each with 200 cows, might be considered sufficient for a satisfactory start.

To this committee applications are made by each of the affiliated societies for the re-insurance of half or quarter of their total risks under the conditions already laid down in the rules for the local societies. If the applications are accepted, half or quarter of the total premiums are paid over to the central re-insuring union, which undertakes to pay half or quarter of the total net losses. These premiums received from the societies, and any interest accruing on them, and any annual receipts from honorary members, form the ordinary resources.

The reserve fund consists of the excess of receipts over expenditure at the end of every year, together with subscriptions for life membership, gifts, legacies, or subventions from the State. Ordinary resources must always be exhausted before the reserve is touched. The reserve must be invested in proper trust securities.

The premiums of such a central society will be found sufficient to enable it to pay for losses up to 4 per cent., but as its risks are so widely spread, the payments are always nearer the average. Such a union will be able to pay its share of heavy losses in any individual society, and even to help by loans societies temporarily hard hit.

With the demand for affiliation the union receives a copy of the rules of the society, a list of its committee and officers, the number of its members and of the cattle insured, and has full powers of investigation to enable it to verify the correctness of the amount of premiums and the regularity of the management, and can decide to accept or refuse the application.

The central union does not interfere with the autonomy of the societies, and is not responsible for bad management, though it inspects, advises and audits. Like the societies, it is not responsible beyond its resources. Societies which fail to observe the rules are liable to forfeit their share of re-insurance indemnities, and societies detected in fraud or attempted fraud or concealment forfeit all indemnity. The reserve fund of the central union is put to the credit of the individual societies in proportion to the amount of their con-

tributions, but it cannot be drawn upon except by the vote of the annual general meeting. The object is to fix to whom it actually belongs, and to regulate that it shall only be used to reduce premiums, to help losses, and to aid co-operation. Each society will thus be seen to have a reserve fund in its own hands, and another reserve fund in the hands of the central union, and will be interested in the growth of both.

The central union has its staff and its organisers, provides all instruction at the start, together with the account-books and printed forms, balance-sheets and audit-forms, and levies, in payment for these services, a small sum annually from each society. The societies engage with the central union for three years, and only at the expiration of three years can the re-insuring rate of premium be altered; then it is fixed again for a similar period, always with a minimum of 1 per cent., below which it must never go. At this triennial settlement societies which have paid in more than they have drawn out from the central union can have a corresponding deduction made from their premium, and societies which have drawn out for losses more than they paid in have a corresponding addition made to their rate of premium, and societies can be refused re-admission.

The above is a summary of the broad general principles on which co-operative live stock insurance on the Continent is organised. The system has up to the present received only a limited recognition in this country, but its wider adoption would undoubtedly be attended by as satisfactory results as have been attained in France, Germany and elsewhere.*

ACREAGE AND LIVE STOCK RETURNS OF 1910.

A SUMMARY table showing the acreage of crops and number of live stock in Great Britain, as returned on the 4th June last, was given in the *Journal,* October, 1910, and some notes on the changes which have occurred since last season are given below. The extent of arable land and

* Information on the Mutual Insurance of Live Stock in Great Britain is given in Leaflet No. 221, issued by the Board of Agriculture and Fisheries; this Leaflet discusses the various points to be considered in drafting the rules for a live stock insurance society.

permanent grass, and of the acreage devoted to the chief categories of crops, may be summarised as follows:—

Crops.	1910.	1909.	Increase or Decrease.	
	Acres.	Acres.	Acres.	Per Cent.
Cereal Crops	7,045,148	7,023,101	+ 22,047	+ 0·3
Other ,, ...	3,111,783	3,203,851	− 92,068	− 2·9
Clover and Rotation Grasses	4,156,417	4,214,575	− 58,158	− 1·4
Bare Fallow	353,876	289,141	+ 64,735	+ 22·4
Total Arable ...	14,667,224	14,730,668	− 63,444	− 0·4
Permanent Grass	17,476,871	17,452,405	+ 24,466	+ 0·1
Total	32,144,095	32,183,073	− 38,978	− 0·1

The area under cereals has again increased, this year by 22,000 acres, or ¼ per cent., and the loss recorded in 1907 and 1908 has now been practically recovered. Other crops (excluding clover and rotation grasses) have declined by 92,000 acres, or nearly 3 per cent., and the area this year is the lowest on record. Clover and rotation grasses have further decreased by 58,000 acres, or nearly 1½ per cent. The area of bare fallow shows the large increase of 65,000 acres, or 22½ per cent., on last year's figures, and is the greatest returned since 1904. On the whole, therefore, the arable area has decreased this year by 63,500 acres, or rather less than ½ per cent., of which 24,500 acres have been laid down to permanent grass.

Wheat, which last year increased by nearly 200,000 acres, has now declined by less than 15,000 acres, or ¾ per cent. Barley and oats, however, have both increased in area this year, the former by 64,000 acres, or nearly 4 per cent., and the latter by 39,000 acres, or 1¼ per cent., the increase in the case of oats again bringing the area under this crop above 3,000,000 acres. Rye shows the relatively large decrease of 7,000 acres, or 13 per cent., and the area this year is the lowest recorded since 1892. Both beans and peas also show considerable decreases, amounting to 44,000 (14 per cent.) and 15,000 acres (8¼ per cent.) respectively.

Potatoes have declined by nearly 36,000 acres, or over 6 per cent., and the area under this crop is the lowest returned since 1898. The area under turnips and swedes has again slightly increased, this year by nearly 10,000 acres, or rather more than ½ per cent. Mangolds, however, have declined by

14,000 acres, or 3 per cent., on last year's area. Cabbage and kohl-rabi together have declined by 8,000 acres, or over 9 per cent., and rape by 6,000 acres, or $6\frac{3}{4}$ per cent., the area under the latter crop being less than in any previous year since 1868. There has been a great decrease in the area of vetches or tares, amounting to 32,000 acres, or $23\frac{1}{4}$ per cent., and the area this year is by far the lowest returned. The area under lucerne has also been considerably reduced, the decrease being 7,000 acres, or nearly $10\frac{1}{2}$ per cent.

The small fruit area has decreased for the first time since 1898, the decline amounting to nearly 3,000 acres, or over 3 per cent. Hops, which, on the other hand, have for some years past very generally, and in recent years rapidly, declined, have now recovered to the slight extent of 350 acres, or rather more than 1 per cent.

The area reserved for hay is greater than last year by 266,000 acres, to which permanent grass contributes 227,500 acres. The grazing area, however, declined 300,000 acres, of which nearly one-third (97,000 acres) is accounted for by rotation grasses. Details are given in the table below.

Crops.	1910.	1909.	Increase or Decrease.	
	Acres.	Acres.	Acres.	Per cent.
Clover and Rotation Grass—				
For Hay	2,074,206	2,035.773	+ 38,433	+ 1·9
Not for Hay	2,082,211	2,178,802	− 96,591	− 4·4
Total ...	4,156,417	4,214,575	− 58,158	− 1·4
Permanent Grass—				
For Hay	5,004,914	4,777,388	+ 227,526	+ 4·8
Not for Hay	12,471,957	12,675,017	− 203,060	− 1·6
Total ...	17,476,871	17,452,405	+ 24,466	+ 0·1

Among live stock horses have lost the whole of the increase noted last year, and the figure for this class of stock is now the same as in 1908. Horses used for agricultural purposes (including mares kept for breeding) continue to increase, the addition this year amounting to 5,000. Unbroken horses of one year and above show a further decline of 12,000, or more than 4 per cent. Unbroken horses under one year are practically unchanged.

The number of cattle is again the highest on record, there having been a further increase this year of 16,000. The

changes in the various classes, however, are not all in the same direction as in previous years: cows and heifers in milk or in calf having declined by 27,000, and calves by 39,000. Other cattle of two years and above, and of one year and under two, show substantial increases of 36,000 and 46,000 respectively, thus reflecting the increases in the latter class and in calves noted last year.

Sheep have more than lost the increase noted last year, the decline amounting to 517,000, or not quite 2 per cent. There is an insignificant increase in the largest class, namely, sheep under one year, but there has been the substantial reduction of 374,000, or nearly 6½ per cent., in the number of other sheep (excluding breeding ewes), while breeding ewes have declined by 146,000, or 1¼ per cent. The number of the latter, however, is still well above that in any previous year, except 1909, since this class was first separately distinguished in the returns.

There has been a further decline of 31,000, or 1¼ per cent., in the number of pigs, the total this year being just under 2,350,000. The decrease, however, is confined to pigs other than breeding sows, the latter having risen by nearly 15,000, or 4¾ per cent., to 331,000.

Powdery Mildew of Peach and Cherry.

This fungus (*Podosphæra oxyacanthæ,* De Bary) often proves very injurious to the peach and cherry, and also occurs less frequently on apple, quince, and various wild rosaceous plants. It first appears under the form of small, scattered, snow-white patches on both surfaces of the young leaves. These patches, under favourable conditions, rapidly increase in size until eventually the entire surface of the leaf becomes covered with a white, powdery substance, which gives it the appearance of having been dusted with flour. The young shoots are also frequently attacked. The peach suffers most from this disease, as the fungus usually passes from the leaves on to the young fruit, where, owing to the dense felt of down, its presence is not observed for some time. Eventually, however, when the chains of conidia are produced, these stand up above the down and show as large white patches, which sometimes

Powdery Mildew of the Peach and Cherry.

encroach on each other and cover the greater portion of the surface of the fruit.

In the case of apple, cherry, and quince, the trees should be sprayed with half-strength Bordeaux mixture on the first appearance of the disease. Diseased shoots should be removed.

Bordeaux mixture, even when very much diluted, cannot be used for spraying peach trees, but a fungicide known as "self-boiled lime-sulphur mixture" can be used on peach foliage without injury. The method of preparing this fungicide is given in this *Journal*, June, 1910, p. 212. It must not be confounded with "lime-sulphur wash," in the preparation of which the ingredients are boiled together over a fire, as this preparation scorches the foliage.

The Allocation of State Aid for Agricultural Research.

In the course of his report to the Board of Agriculture and Fisheries on the Distribution of Grants for Agricultural Education and Research during 1908–9 and 1909–10,* Mr. Middleton refers to the improved prospects of agricultural research owing to the passing into law of the Development and Road Improvement Funds Act of 1909, and discusses some of the general considerations which bear on the question of State aid for the investigation of agricultural problems.

A public department, he points out, when authorising the expenditure of money on research is bound to take into consideration the probable value of the work to the State. It cannot rest satisfied with the assurance that sooner or later all accessions to knowledge will benefit the country. The taxpayer of to-day naturally wishes to see a return for his contribution, if not in his own lifetime, at least in that of his children. It is obvious, therefore, that, as a matter of elementary justice, the question of time must receive consideration from any department entrusted with the expenditure of

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* This Report [Cd. 5388, Price 7½*d.*], in addition to a general Report on the Grants made in the years named, describes the recent change in the arrangements for Agricultural Education which has been agreed upon between the Board of Agriculture and the Board of Education (see *Journal*, Oct., 1909, p. 529). It also contains particulars of courses of instruction, &c., at the institutions to which grants are made, and information as to the agricultural work of County Councils.

State funds on research. This obligation may make it difficult to resist the demands of those who call for early results; but on the other hand these demands must be resisted if the State is to avoid squandering its resources. Nothing is more certain than that much of the best work, and the work which most deserves the aid of the State, is of a kind which cannot be hurried, or than that no genuine scientific worker can grind out results to order.

As a preliminary question, it may be asked what is Research? What may be included and what must be excluded when the time comes for discriminating between the various claimants for assistance from funds provided for the improvement of agriculture? A certain class of agriculturist holds that all that there is to learn about agriculture must be learned on a farm, another class, now perhaps more numerous, but not more logical, supposes that when any agricultural product is transported to a laboratory it becomes then, but not till then, a subject for research. But in fact the "expert" agriculturist laying out manurial plots on a farm, or the chemist analysing agricultural products in his laboratory, may be no more engaged in research than the farm labourer, or the miller, carrying out his routine tasks. In order that work may become research it must satisfy one or both of two conditions: (1) it must, as a result of observation or experiment, result in the collection of fresh facts; (2) it must involve an examination of the facts collected, or phenomena observed, and the reduction of them to a form in which they constitute an addition to knowledge.

It is not usually a difficult task to distinguish research from spurious imitations; on the other hand it may at times be difficult to say whether a particular piece of research is, or is not, entitled to receive aid from agricultural funds. One may be permitted to express the hope that the public interested will not take a narrow view on this point. Representatives of the agricultural interests may at first be disposed to claim that aid should be given only to those who are engaged in work which is definitely agricultural; but the effect of this claim, if it were recognised, would be to restrict the field from which Agriculture may expect aid and ultimately to injure the industry. As the claims of Agriculture on the

Development Fund are obviously greater than the claims of Agriculturists, the first endeavour should be to find out and aid those scientific men who, whether agriculturists or not, are best qualified to give the industry the assistance which it needs. In many directions, especially perhaps in the formation of new cultivated plants, and in the study of disease whether of plant or animal, we must look for workers outside, as well as inside, the ranks of those who are now engaged in studying agricultural and veterinary subjects.

At the present time the number of well-qualified men engaged in agricultural investigation in this country is relatively small, and one of our chief aims in expending additional funds should be to establish a system which will bring agricultural science suitable recruits. Here again we must be prepared for criticism. The agricultural public are so impressed by the achievements of great scientific men, that it will take some time to convince them that the average research worker is "made" not "born."

It is true, of course, that the geniuses are "born," just as they are in other walks of life. It is further true that special gifts are necessary in directors of scientific research, but in building up the principles of science all are not "architects," workers of many grades must co-operate, and the chief demand of the present time is for "spade workers" and "quarrymen" to prepare foundations and material. If we examine the history of British science, we find that we are not behind other nations in the matter of "architects"; indeed, we may lay claim to more than our own share of scientific genius; where we have failed is that we have not followed up the work of our "architects," and thus when we are in want of examples illustrating the power of organised science we must refer to the experience of other countries, such as Germany, where, chiefly because of the degree-granting system of the universities, "research" is part of the task of ordinary men. The progress made by German industries is not so much the result of scientific genius as of trained "scientific labour." Mr. Middleton goes on to illustrate the point from the experience of the United States, where the provision of Experiment Stations in 1887 has been followed by most beneficial results.

The most pressing question which confronts those responsible for the development of agriculture is the system on which any funds which the Development Commissioners may allot for research are to be utilised. Whether in establishing one or two central stations, or by spreading the grants over a number of institutions?

This question is one on which Agriculturists are not agreed. Among a certain number the opinion is held that better results would follow on the adoption of the first system. It is alleged that there has been a great deal of waste in connection with the experimental work carried out by local authorities with the aid of the "Whisky Money," and fears are expressed that if the Development Funds were used to encourage local research, this experience would be repeated. But the "Whisky Money" was placed at the disposal of Technical Instruction Committees who had, when appointed, no special knowledge of experimental work, and under such conditions disappointment might have been anticipated. It is not suggested that this method of allotting funds for local use should be repeated; those who are in favour of decentralisation in research work assume that the expenditure of research funds would be entrusted to universities, colleges, institutions or associations of persons capable of utilising funds for research; and it is pointed out that the wording of the Act clearly indicates that this is what was contemplated. We have in the country endowed institutions, such as the Rothamsted Experimental Station for research in agriculture and the John Innes Institution for work in horticulture, we have universities offering great advantages to those undertaking original investigation, and agricultural and veterinary colleges in which research has already been begun. Through these institutions it is argued we are more likely to utilise Science for the benefit of Agriculture than would be the case if we established a central experimental station for each country.

From a purely administrative point of view a State Research Station would offer certain advantages, but it is only necessary to examine the character of the work to be done to see that much of it must necessarily be local. The diseases of animals and plants might be studied with advantage up to a point

at one central institution for the whole country, but when methods of prevention and remedy come into the question, and this is more especially the case with plant diseases, local study is essential. The breeding of new plants is to a certain extent a local problem, for different qualities are required in different districts. Questions bearing on the cultivation and profitable treatment of soil are usually of a local character.

Apart from the character of the work to be done there are strong reasons for developing research, as educational work has already been developed, at local centres throughout the country. In the first place we must remember that what is required of investigators aided by the State is not only that their researches shall add to existing knowledge, but that this new knowledge should be translated into practice by farmers. Scientific work, however satisfactory from an academic standpoint, is incomplete work from the point of view of the development of agriculture until the farmer is reached by it. Theoretically a principle discovered in Germany or the United States should at once, through our agricultural colleges and schools, reach the farmer in any part of Britain. But there is little energy to be got out of reflected light, and the enthusiasm of farmers cannot be aroused over foreign work. Had it been otherwise it is not likely that we should now have had so many resolutions from associations of progressive agriculturists asking that money shall be spent on research, for the volume of agricultural research in progress in foreign countries is very great. Owing to the difficulty of influencing an agricultural community at a distance, Mr. Middleton regards it as unlikely that one central station would be satisfactory in England.

In considering the location of research note must be taken in the next place of its effects on teaching institutions. There can be no question that if these institutions shared in the funds intended for research purposes their efficiency from the educational standpoint would be greatly increased. It is now generally admitted that no institution engaged in higher instruction can be in a healthy condition unless some, at least, of the staff are themselves students engaged in original work. On this point there has been a marked change in English opinion in the last ten years. This change was commented

on by the inspectors appointed to report on the Colleges receiving Treasury grants, and in their Report to the University Colleges Committee (H.C. 267, 1907) they express the following opinion:—"Of all the tests by which the vitality and functional activity of a College may be judged, the surest is, speaking generally, the extent to which the members of the staff and the senior students are engaged in research." When a teacher shows first-hand knowledge of any subject his influence with his pupils and with the farmers in his locality is immensely strengthened, and for this reason while the main business of our agricultural colleges continues to be instruction, we could not afford to lose the opportunity which the Development Fund may give us of encouraging the governors of these institutions to make provision for investigation.

There is a further strong reason for not concentrating all the available funds on one or two institutions. At the present time, as has already been remarked, comparatively few men engaged in agricultural research in this country have had the training and experience necessary to enable them to utilise to full advantage grants from the Development Fund. On the other hand there are probably a number of competent scientific workers in our universities who would be prepared to take up agricultural questions if grants were made for the purpose. We have seen that in all the Colleges aided by Treasury grants research is in progress, and it would probably be advisable, therefore, to use part of the Development Fund in making such grants to universities and university colleges as would induce them to make provision for agricultural research. Some at least of the professors and lecturers employed in our higher teaching institutions would be prepared to act as directors of research laboratories, and some at least of the junior lecturers and senior students may be expected to furnish the skilled labour necessary. It is quite true that in principle the function of the teacher is different from that of the investigator; it is also true that many excellent teachers fail as investigators, and that some of the best investigators are poor teachers. Much has been made of these points, and some years ago there was among agriculturists in this country an idea that teaching and research

should be kept separate. But while in principle the functions of teacher and investigator may be different, in practice they are closely associated, and no science teacher in a university or college can now afford to neglect research. Those who argue for the separation of education and research forget that the teacher must continue to be a student, and that the adult student who does not engage in original investigation of some sort cannot be a very satisfactory member of a college staff.

Measures for the Destruction of the Warble-fly on the Continent.

Efforts have been made in recent years in several Continental countries * to free the cattle from the attacks of warble flies by concerted action. Various measures have been tried, but the method which has proved most efficacious and which has been used in most cases has been to examine the cattle before sending them out to pasturage in the spring, and squeeze out the maggots after making a slight cut in the warbles.

To obtain the fullest possible measure of success the co-operation of all the cattle-breeders of the district is necessary. In Denmark a local agricultural society in Jutland has carried on a systematic campaign since 1901. This society each year divides all the cattle of the district into ten groups, and places each group under the charge of a man, who is employed to visit all the animals in his group from four to six times during the summer and extract the maggots. A special extractor is used for making the incision in the warbles, and the slight wound thus caused heals much more rapidly than the perforation made by the maggot. In 1902 22,394 warbles were extracted, at a total cost of £16 2*s.*, or 1*d.* per head of cattle. From that time the number of warbles decrease progressively, more than half of those extracted in subsequent years coming from the small number of animals that had been newly acquired. The number of cattle treated has not varied greatly from year to year, and the decrease in the prevalence of warbles is

* *Bulletin de la Société National d'Agriculture*, No. 3 and No. 6, 1910.

shown by the fact that in 1909 from 2,290 cows and 1,585 calves examined only 5,042 warbles were extracted. The cost was £7 10*s*., or less than ½*d*. per head of cattle. Encouraged by these results, other districts in Denmark have undertaken the systematic destruction of warbles.

In other countries, doubtless owing to the measures taken not being sufficiently general and thorough, less favourable results have been obtained. In Prussia the Government have for the last fifteen years made efforts by means of the distribution of leaflets on the subject, to induce farmers to free their cattle in the spring, but with small success. In consequence, proposals were made in 1905 by the Association of German Tanners for legislative measures to make the destruction of warbles obligatory. The question was considered by the Prussian Board of Rural Economy, who reported against legislation, and recommended that voluntary action should be relied upon, owing to the irregular distribution of the warble flies, the difficulty of administration of any such legislation, and the dislike of farmers to restrictive measures. A demand still exists, however, for means to compel farmers to adopt measures against warbles in districts where the majority wish to take action, so that the cattle of the more backward cultivators should not be the means of keeping up the infestation. A representative Committee was appointed in 1910 to consider what steps could be taken to spread information on the subject.

In the Grand Duchy of Oldenburg a compulsory measure for the purpose of eradicating the pest in one district has actually been adopted. Every cattle-owner in this district is required by a regulation of the Minister of State, of 11th March, 1910, under penalty of a fine not exceeding £7 10*s*., to examine his animals and destroy the warble maggots between the 15th March and the time of turning the cattle out to grass. The cattle are to be inspected by officials of the local authorities to ensure that the regulation has been complied with.

The Agriculture Committee of the Royal Commission on the Brussels, Rome and Turin Exhibitions have communicated to the Board a Report on the Live Stock Exhibit which was prepared by the Committee for the Brussels Exhibition.

Live Stock Exhibit at the Brussels Exhibition.

It will be remembered that this Committee, on which the Board of Agriculture was represented, was appointed with a view to assisting individual exhibitors and generally to encourage the export of pedigree live stock to the Continent.

As it was obvious that it would be impossible to show live stock in an Exhibition that would remain open for six months, the Committee determined to ask the Breed Societies to co-operate with them in the organisation of a pictorial exhibit composed of large photographs of typical animals, with short descriptions in three languages of the chief merits of the different breeds.* This exhibit was successfully staged, but was, unfortunately, destroyed in the fire which occurred at the Exhibition on August 14th last. The exhibit itself was amply insured to cover the cost of production, but nothing could compensate for such a loss at a time when many agriculturists were visiting the Exhibition, and important practical results might reasonably have been expected from the advertisement. Fortunately, a duplicate of the exhibit had been sent out to the Agricultural Exhibition at Buenos Aires, and this the Board of Trade has undertaken to send on to the International Exhibition which will be held next year at Turin.

The Committee are of opinion that it is most desirable that this system of advertisement once commenced should be continued so that the Breed Societies and the Breeds which they represent shall be brought prominently before the public in different parts of the world. Every endeavour will be made at the International Exhibition at Turin to add to the attractions of the exhibit, but to do this a certain expenditure will be required from time to time, and it is hoped that the Breed Societies will agree to the balance which still remains in the hands of the Committee being used for that purpose.

* A photograph of the Exhibit and some further particulars appeared in this *Journal*, May, 1910, p. 127.

The Report prepared by the Committee on the results of the exhibit is as follows:—

The position secured for the graphic advertisement of "Breeds of British Live Stock" could hardly have been improved on in the whole of the Exhibition. Situated on the bridge connecting the two main buildings, with the British and Belgian sections on the one side and those of France, Italy and various other nations on the other, it was at the heart of the Exhibition. The majority of visitors were bound to pass in close proximity to the section, and it is safe to assume that fully 85 per cent. of the huge crowds daily attending the Exhibition could not fail to notice the illustrations of British live stock. This exhibit, it is only fair to say, was worthy of the prominence assigned to it; it was admitted by all visitors and by the members of the International Jury, to be more imposing than the Agricultural Section of any other nation in the exhibition, and it secured the highest possible award—a Grand Prix. The Jury also specified that each Breed Society should receive a copy of the Diploma of the Grand Prix.

As an advertisement, therefore, there can be little doubt the exhibit was all that could be desired. It was attractive and imposing in its general appearance, and was so placed that it was impossible for anyone not to see it.

It must, of course, be pointed out that with an exhibit of this nature, immediate results cannot be expected. Judging from the number and class of inquiries that were made during the three and a half months that the exhibit was open to the public, it is hoped that good results will follow. Some callers stated their intention of coming direct to this country to purchase stock. The majority, however, although evidently impressed by the photographs and descriptive matter, were naturally disposed to give the matter careful consideration before opening up negotiations for purchase. In view of this very reasonable attitude, it is evident that the information given in the pamphlets supplied by the Societies for free distribution formed a most important factor in the advertisement scheme. This point was probably not fully appreciated at the outset, and consequently, in almost every case, there

was room for improvement in the class of information and the style in which it was issued.

The exacting Continental farmer is accustomed to place more faith in performance than in show "points," and, no matter how impressive the photograph, he will not be induced to invest unless he is satisfied by properly authenticated statistical evidence of the utility and merits of the animal. The eagerness with which the volume of milk records contributed by one of the Societies was sought and perused indicated the means by which British breeders can develop a Continental trade. The Continental farmers and breeders are prepared to purchase only such animals as will yield them better returns than they obtain from the breeds they own at present, and it rests with the British breeder to convince them that the live stock of this country is capable, in many ways, of surpassing the Continental breeds. This can be done by laying before them, in an attractive and comprehensive form, official statistics and authenticated evidence of milk and butter-fat records, early maturity, weight, quality of meat, quality of wool, hardiness, value for cross-breeding and grading up and of the many other points for which British stock are renowned.

Another point which should be emphasised in dealing with the foreign buyer is the variety of climate and conditions under which British stock are bred, thus fitting them for movement to any part of the world.

Above all, the information must be given in the language of the person to whom it is handed. The handbook, "Breeds of British Live Stock," issued by the Board of Agriculture and Fisheries, is intended to provide a brief general account of each breed, but details such as could not be conveniently incorporated in a single handbook are wanted, and each Breed Society may therefore be recommended to prepare full and accurate record of the qualities, capabilities and performances of its breed, and have it published in an attractive form in English, French, Italian, German and Spanish, in order that inquirers may take with them to their homes, for full consideration, the information they desire, and which is a necessary preliminary to useful business.

It was realised at the outset that a very valuable advertisement would be secured by sending over a number of specimen animals to be shown in the vicinity of the Exhibition. A Belgian butcher's agent arranged to purchase a number of various breeds of sheep, which he agreed to exhibit on his premises for a period before they were slaughtered. Unfortunately there was some little delay in collecting and arranging for the shipment of the animals, and when arrangements were at last completed the agent refused to accept them. Every endeavour was being made to secure another purchaser willing to exhibit before slaughter, when the outbreak of foot and mouth disease in this country made it impossible to secure the necessary authority for the importation of live animals from the Belgian Department of Agriculture.

It may be claimed that as a pictorial advertisement the Brussels exhibit has fully justified the expense and trouble that its preparation incurred. The Committee now wish strongly to urge the necessity of individual breeders of this country to follow up the interest that has been created thereby. Unfortunately the lengthy lists of names and addresses of persons who made inquiries at Brussels were destroyed in the great fire. There are means, however, other than by direct communication, by which these persons may be reached, for instance, by advertising in the Continental papers, and it is hoped that the opportunity will not be lost by the breeders of this country.

The necessity for the appointment of an official Continental and foreign selling agent or agents has been abundantly demonstrated at Brussels. The foreign buyer apparently objects to dealing direct with the breeder, at any rate in the preliminary stages. He would much prefer to get into communication with a thoroughly reliable official selling agent, who would give him, in his own language, the particulars he requires as to choice of animals, prices, freight charges, transport facilities, import and export regulations, &c. The appointment of such a man would, without doubt, facilitate to a great extent the live stock trade, and it is a matter which should receive the careful consideration of the Breed Societies of this country.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

MISCELLANEOUS EXPERIMENTS.

Turnip Manuring Experiments, 1909 (*Aberdeen and N. of Scot. Coll. of Agric., Leaflet No.* 11).—Manurial trials with turnips have been carried on for six years, the results of a complete dressing being compared with dressings from which one of the ingredients was omitted. The average crops in six years were :—Without phosphates, 10 tons 18 cwt.; without nitrogen, 17 tons 1 cwt.; without potash, 16 tons 6 cwt.; complete dressing, 19 tons 6 cwt.; unmanured, 8 tons 12 cwt.

Calcium cyanamide and nitrate of lime as manures for the turnip crop were compared with sulphate of ammonia and nitrate of soda. Four plots were treated with superphosphate and potash, and with nitrogenous manures in the following quantities :—Calcium cyanamide, $\frac{7}{8}$ cwt.; nitrate of lime, $1\frac{3}{8}$ cwt.; nitrate of soda, $1\frac{1}{8}$ cwt.; sulphate of ammonia $\frac{7}{8}$ cwt. The yields from the four fertilisers, both with and without the application of dung were, on the average, practically identical.

The effects of Algerian, Belgian, and Florida phosphates were compared with superphosphate. The quantities of each used were :—Superphosphate, $5\frac{3}{4}$ cwt.; Florida phosphate, $2\frac{1}{2}$ cwt.; Belgian phosphate, $4\frac{5}{8}$ cwt.; Algerian phosphate, $3\frac{1}{8}$ cwt. With farmyard manure the yields from the three were equal; without it Algerian phosphate gave the best results, taking the average of ten trials, though it was not quite equal to superphosphate.

Experiments with Swedes and Turnips (*Northumberland C.C. Educ. Com., Bull.* 14, *Guide to Expts. at Cockle Park for* 1910).—Experiments with different varieties of swedes and turnips have been in progress at this station for a number of years, and the average yield, percentage of dry matter, and the number of roots per acre are given in this Bulletin.

The percentage of dry matter in five varieties of swedes has been ascertained during ten years and indicates that the feeding value of swedes varies greatly from season to season. A comparison of these percentages with the summer frosts at Cockle Park has been made, and suggests that swedes are likely to be richer in dry matter when such frosts are not very prevalent.

A trial was also made as to the most profitable form of application of potash manures to swedes. The differences in the crops were too small to admit of any conclusions being drawn.

Experiments with Mangolds and Cabbage (*Northumberland C.C. Educ. Com., Bull.* 14, *Guide to Expts. at Cockle Park for* 1910).—Tests of two varieties of mangolds have been conducted during the years 1905–9, Mammoth Long Red being selected as a deep-growing tankard variety and Prizewinner Yellow Globe as a shallower growing and more easily raised variety. The average crops were :—Mammoth Long Red, 20

* The summaries of agricultural experiments which have appeared in the present volume have been as follows :—Cereals, April; Cereals and Root Crops, May; Root Crops, June; Root Crops and Potatoes, July; Grass and Clover, August; Cereals, September; and Miscellaneous Experiments, October. The Board would be glad to receive for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

tons 11 cwt.; Prizewinner Yellow Globe, 20 tons 4 cwt. The percentage of dry matter in the roots was greater in Mammoth Long Red, so that the total weight of dry matter per acre produced by it was 2 tons $8\frac{1}{2}$ cwt., while that of Prizewinner Yellow Globe was 2 tons 2 cwt.

From the results of trials carried out in the five years 1903–7 it was concluded that nitrate of soda, basic slag, and sulphate of potash were the most suitable artificials for the mangold crop on this soil, viz., a loam lying on a subsoil of Millstone Grit sandstone mixed with clay. The following standard dressing was therefore compared with various other combinations in 1908 and 1909:—$4\frac{1}{2}$ cwt. nitrate of soda, 2 cwt. basic slag (39 per cent. phosphate), $2\frac{3}{4}$ cwt. sulphate of potash, and 2 cwt. common salt. This produced an increase of 9 tons 4 cwt. over the unmanured crop, and 4 tons 11 cwt. over the plot with 12 tons of farmyard manure.

Cabbages were grown in the centre of the mangold plots, with the same system of manuring. Farmyard manure was much more effective than with the mangold crop, and the following dressing is recommended:—10 to 12 tons farmyard manure, 1 cwt. nitrate of soda, 4 cwt. basic slag, and 1 cwt. muriate of potash, all applied in the drills, with the addition of $1\frac{1}{2}$ cwt. nitrate of soda applied in two top-dressings. On the heavier classes of soils the muriate of potash might be omitted.

Experiments with Potatoes (*Northumberland C.C., Educ. Com., Bull.* 14, *Guide to Expts. at Cockle Park for* 1910).—Varieties and change of seed.—A number of varieties were grown in 1909 from seed obtained from Scotland the same year. The soil was a sandy loam, which was manured with 12 tons of farmyard manure per acre. The heaviest yields in stones per pole, which is equal to tons per acre, were:—Factor, $13\frac{1}{2}$; Dalhousie Seedling, $11\frac{3}{4}$; Up-to-Date, $10\frac{3}{4}$; Table Talk, 10; Mayfield Blossom, 10. Four of the varieties were also grown from seed obtained from Scotland in 1908, and grown in England in that year. Factor and Dalhousie Seedling gave three to four tons more per acre from the fresh Scotch seed. Mayfield Blossom gave about equal results, while with Table Talk the crop from the seed grown one year in England was better, viz., $12\frac{1}{4}$ tons per acre. Golden Wonder and What's Wanted, two varieties that have been found to resist infection by Wart Disease, gave yields of $8\frac{1}{4}$ and $7\frac{3}{4}$ tons per acre respectively, with seed fresh from Scotland.

Winter and Spring Planting.—This trial has been carried on for four years, 1906–9. In each year a heavier crop was obtained by planting in March or at the beginning of April than by planting in October, December, January, later in April, or in May.

Sprouted *v.* Unsprouted Seed.—The sprouted seed gave a yield of 3 tons per acre more than the unsprouted.

Seeds Mixtures for Permanent Grass Land (*Univ. Coll., Reading, Bull. vii.*).—Trials are in progress with various seeds mixtures, and the results for 1909 are given in this Bulletin, with a description of the scheme of the experiment.

Grass and Clover Seeds and Seeds Mixtures (*Northumberland C.C. Educ. Com., Bull.* 14, *Guide to Expts. at Cockle Park for* 1910).—Four one-acre plots were sown with one-year seeds mixtures in 1907

and 1908, in each case with barley. The most successful mixture contained :—Perennial ryegrass, 15 lb.; Italian ryegrass, 8 lb.; English red clover, $8\frac{3}{4}$ lb.; trefoil, $2\frac{3}{4}$ lb., and alsike, $1\frac{3}{4}$ lb.; total, $36\frac{1}{4}$ lb. per acre, costing 14*s.* 7*d.* On a heavy loam in 1908 the crop with this mixture was 29 cwt., and on a sandy loam in 1909 $38\frac{3}{4}$ cwt. With a larger proportion of Italian, and less perennial ryegrass, the crop was smaller. This was also the case when both ryegrasses were decreased by a quarter.

It has been found advantageous to leave the "seeds" down for three years and upwards, on some thin, poor clay soil lying on Boulder Clay, and four seeds mixtures were sown with the object of finding the most suitable for this purpose. The plots were $\frac{1}{4}$ acre in area, and were sown down on wheat, after summer fallow, in the spring of 1906. They were cut for hay in the three years 1907–9, and the best results were given by a mixture costing 29*s.* per acre, made up as follows :—Perennial ryegrass, 6 lb.; Italian ryegrass, 6 lb.; cocksfoot 6 lb.; timothy, 3 lb.; meadow fescue, 8 lb.; red clover, 4 lb.; alsike, 2 lb.; white clover, 4 lb.; wild white clover, 4 lb. The crop from this mixture averaged $28\frac{1}{3}$ cwt. per acre. The most valuable plant in the mixtures was wild white clover. On two plots where it was sown a remarkable carpet of white clover developed, while ordinary white clover failed to produce plants.*

A part of the plots was dressed with different manures, 10 cwt. of basic slag being compared with 10 tons of farmyard manure, and with these two manures together. Wherever clover was sown the slag gave more hay than farmyard manure, or than farmyard manure and slag together, probably because the dung, in developing the grasses, tended to repress the clovers.

Seeds Mixtures for Permanent Pasture (*Holmes Chapel Coll. of Agric. Year Book,* 1909).—Five seeds mixtures were sown in 1907 on a heavy clay soil. These comprised a cheap temporary mixture, costing 18*s.* 8*d.* per acre, a variation of the "Elliott" mixture, which includes burnet and other deep-rooting plants, permanent mixtures with and without perennial ryegrass, and the mixture used for 9 acres of pasture which was being laid down. Notes are given on the appearance of the grass in the first two years.

Grass Seed Mixtures (*Aberdeen and N. of Scotland Coll. of Agric., Bull.* 15).—This experiment dealt with seeds mixtures for the three years of temporary grasses which are included in the common rotation of the North. The usual mixtures of ryegrasses and clovers were compared with others containing smaller proportions of ryegrass or without ryegrass, its place being taken by natural grasses or deep-rooting plants. The results of the mixtures in providing hay in the first year and pasture in the second and third years, and their effect as regards weeds and the improvement of the soil are recorded. The conclusions are generally unfavourable to large seedings of ryegrasses.

Seeds Mixtures for Temporary Ley (*Field Expts. at Harper Adams Agric. Coll., and in Staffs and Salop,* 1909.)—Various mixtures of ryegrass and clovers were sown in 1907 and 1908 for a one-year's ley. Three mixtures of Italian ryegrass and clover, costing 19*s.* 7*d.*, 13*s.* 1*d.*, and

* See *Journal*, December 1909, p. 713.

10*s.* 4*d.* per acre, gave almost equal results. Possibly the best was a mixture composed of red clover, 4 lb.; white clover, 4 lb.; alsike, 2 lb.; Italian ryegrass, 2 lb.; perennial ryegrass, 4lb.; total, 16 lb. per acre. This cost 11*s.* 3½*d.*, or 8½*d.* per lb., and produced in 1908 2 tons 7 cwt. of hay, and in 1909 2 tons 1 cwt.

Wild White Clover (*Dept. of Agric. and Tech. Instr. for Ireland, 8th Rept. on Expts. on Field Crops in Co. Antrim*, 1909).—During several years a considerable number of experiments have been carried out with seeds mixtures for pasture. Some of the plots have now been grazed for four years, and the outstanding feature has been the success of wild white clover. On the plots on which ordinary white clover was sown there is now only an odd plant, but the wild white variety still grows luxuriantly. Two to four pounds per acre of this instead of the ordinary white clover are recommended.

Manuring of Pasture (*Northumberland C.C. Educ. Com., Bull.* 14, *Guide to Expts. at Cockle Park for* 1910).—These experiments on the improvement of poor pasture, which have been carried on in Tree Field since 1897, were designed to test the question whether the application of artificial manures would, at a less cost, so improve the herbage that sheep would lay on more mutton than animals fed with cake while grazing unmanured land. The results for the nine years 1897–1905 were summarised in the *Journal* for December, 1906, p. 549. The soil, which is of a most even character, is a poor clay and clay loam, lying on a subsoil of poor Boulder Clay. Before 1897 it was worth only 2*s.* 6*d.* per acre per annum for grazing purposes. There are eleven plots, each $3\frac{1}{20}$ acres in area. A new scheme of treatment was begun in 1906. The plots are now grazed by sheep for fourteen weeks each summer, and the sheep are weighed every seven weeks. The most important results (per acre) are shown in the following table, the last column being obtained by valuing at 3¾*d.* per lb. the mutton produced on the manured plots in excess of that on the unmanured plot, and deducting the cost of the treatment:—

Treatment for 1906 and later.	Cost of treatment (4 years.)	Average of 4 years 1906–9. Live-weight increase of sheep over unmanured plot.	Average of 4 years 1906–9. Average annual gain.
	£ s. d.	lb.	£ s. d.
600 lb. decorticated cotton cake fed to sheep annually till 1908 ...	6 8 7	121	5 7
Basic Slag, 10 cwt., 1906	1 4 4	109	1 8 0
Basic Slag, 5 cwt., 1906, repeated, 1909	1 4 4	84	1 0 2

The addition of potash, lime, or nitrate of soda to the dressing of slag has not given any adequate return.

Another experiment on Hanging Leaves Fields has been carried on during 1903–9, the object being to ascertain how the improvement commenced by basic slag can be maintained and developed. The results show that slag is the most effective manure for this purpose, as it supplies both phosphates and lime, which are deficient in this clay soil. The soil is also deficient in nitrogen, but this is collected by the roots of the leguminous plants, which are developed by the

slag. For this reason neither the nitrogen in the cake nor in the fish meal gives adequate returns.

In the Tree Field experiment the plots can be grazed with sheep only, while in Hanging Leaves Fields the plots are more than three times as large, and are grazed with a mixed stock of cattle and sheep. The soil and the original condition of the pasture in the two fields were practically identical, but the live weight gains by grazing with both cattle and sheep have been almost double those obtained by grazing with sheep alone. The explanation of this is that the sheep graze the fine bottom herbage closely and leave that of a rough benty character, which is therefore encouraged to some extent. Cattle, on the other hand, graze more evenly and less closely, without specially selecting the finer herbage, so that the general results are more favourable to the pasture.

Other experiments at Cockle Park have been :—(1) Davy Houses Field—manuring of old pasture on a light sandy soil on Millstone Grit sandstone. The results of this show that the good effects of slag on pasture are not confined to clay soils. (2) Davy Houses Field—basic slag *versus* bone meal. Slag is proving most effective on a clay loam and on a light sandy soil. (3) Back Butts Field—a comparison of the effects of various forms of lime is being made here. (4) West Well Close —effect of phosphates on a loamy pasture of considerably better quality than Tree Field. Slag is also effecting great improvement here. (5) Palace Leas Field—manures for meadow hay. Phosphates (mainly basic slag) have given the most profitable returns. Farmyard manure alone has given a profitable return, but when combined with artificials, though the crop was heavy, the hay was of the poorest feeding quality. (6) Palace Leas Field and Long Riggs—comparison of high- and low-class basic slags, equal quantities of phosphates being applied. Analyses are given of the slags used in these trials.

Varieties of Lucerne (*Jour. Roy. Agric. Soc., Vol.* 70, 1909).—Three varieties of lucerne, Provence, American, and Canadian, were sown in 1905. The weights of green produce, from three cuttings, in 1909 were :—Provence seed, 10 tons 11 cwt.; American seed, 11 tons 9 cwt.; Canadian seed, 16 tons 19 cwt. The Canadian variety has now for four years yielded the largest crop, and appears likely to last the longest, as weeds and grass are beginning to overrun the other two. These latter have been about equal in crop. Plots were sown in 1908 with three Argentine varieties, but they were attacked by a fungus disease. The crops were cut down close and ground lime applied at the rate of one ton per acre. The crop in 1909 was free from disease, but only amounted to about two tons per acre with each variety, and the plots were ploughed up. The Canadian and other varieties remained free from the disease, though they were in close proximity to the attacked plots.

Forage Crops (*Roy. Agric. Coll., Cirencester, Scientific Bulletin, No.* 1, 1909).—The plants dealt with are *Lathyrus sylvestris*, the Wood Vetchling, or Wagner's Flat Pea, and *Bromus erectus*, the Upright Perennial Brome. The crops produced and analyses of the hay are given.

Rotation Experiment (*Jour. Roy. Agric. Soc., Vol.* 70, 1909).—The purpose of this experiment is to compare the manurial values of decor-

ticated cotton cake and maize meal fed to live stock during a rotation. The comparison is made with two different systems of manuring—(*a*) feeding the cake or corn on the land to sheep, and (*b*) manuring the swede crop with dung made at home by bullocks consuming cake or corn. The results for 1909 are given, the rotation not being yet finished. No marked differences were shown between the results from the cake and maize meal.

Rotation Experiments (*Rothamsted Expt. Stat., Ann. Rept.,* 1909).—The Agdell Field has been farmed since 1848 on a four-course rotation of swedes, barley, clover (or beans), or fallow, and wheat. It is divided into three plots, one of which has received no manure, one mineral manures only, and the third a complete manure, containing the same minerals and also nitrogen. Each of these plots is subdivided into two; one-half carries clover or beans as the third crop of the course, and the other half is bare fallow. This report contains the weights of the crops during the last complete course of the rotation (1904–7), and the first two years of the present course, in continuation of the results discussed in the Guide to the Experimental Plots, 1906.

In another experiment wheat (unmanured) has alternated with fallow each year since 1851, for comparison with the plot on which wheat has been grown every year without manure.

Manuring of the Rotation (*E. Suffolk Educ. Com. and Camb. Univ. Dept. of Agric., Rept. on Manurial Expts. at Saxmundham and Bramford to end of* 1907).—Two rotations were completed in 1907 on the manurial plots at these experimental stations. At both places a four-course rotation of roots, barley, leguminous crop, and wheat was followed, and the land was divided into four parts, so that each year it carried the four crops of the rotation. Each of these parts was divided into ten plots of $\frac{1}{20}$ acre each, which received different manurial treatment. The results over a period of eight years are discussed in this report.

OFFICIAL NOTICES AND CIRCULARS.

Directory of Agricultural Associations.

The Board of Agriculture and Fisheries have recently issued a Directory of Agricultural Associations in Great Britain, giving, so far as could be ascertained, a list of all the Societies and Associations having reference to Agriculture and its allied industries, with the name and address of the Secretary in each case.

The list includes, in the first place, all the societies whose sphere of operations is not confined to any one county or district, and these are classified under the following headings:—General: Agricultural Associations and Chambers of Agriculture, and Co-operative Societies; Live Stock Societies, distinguishing societies relating to horses, cattle, sheep, pigs, goats, and poultry. In the same way, societies relating to Horticulture, Dairying, Forestry, Hops, Milling, Education, Research, and some other subjects are separately grouped. The local societies are arranged so as to show the Agricultural Associations, Chambers of Agriculture, Farmers' Clubs, Co-operative Societies, In-

surance, Credit, Poultry, Bee-keeping, and other societies in each county. An alphabetical index is added at the end.

A copy of this Directory may be purchased, either directly or through any bookseller, from Messrs. Wyman and Sons, Ltd., Fetter Lane, E.C.; or Oliver and Boyd, Tweeddale Court, Edinburgh; or E. Ponsonby, Ltd., 116 Grafton Street, Dublin; price 9*d*., by post 10½*d*.

It is of interest to note that the list of names given in this Directory shows that there are 20 Agricultural Associations, and Societies, and Chambers of Agriculture of a general (non-local) character; 11 Central Co-operative Societies; 12 Societies for Horse-breeding; 22 for Cattle-breeding; 26 for Sheep-breeding; 6 for Pig-breeding; and 82 Poultry Societies. In addition, the list of non-local societies accounts for 12 Horticultural Societies, 12 Dairy Societies, and 3 Forestry Societies.

Education and Research is represented by 22 Schools and Colleges in England, 2 in Wales, and 5 in Scotland, together with 4 Veterinary Colleges. There are, in addition, 4 Experimental Stations and 5 Associations connected with the subject.

As regards local societies, the following groups are represented:—

	England.	Wales.	Scotland.
Agricultural Associations, Chambers of Agriculture, and Farmers' Clubs	563	43	265
Live Stock and Show Societies	186	19	35
Bee Keepers' Associations	33	1	—
Co-operative Societies—Agricultural	134	54	43
Small Holdings	150	7	—
Insurance	60	2	1
Credit	25	2	—
Poultry	26	1	2
Total	1,177	129	346

It would thus seem that a total of some 1,652 separate organisations for the promotion in various ways of local agriculture exist in Great Britain, while there are, in addition, some 300 organisations whose operations are of a more general and national character. Many of these associations, it is true, vary very considerably in importance, from certain large societies whose members are numbered by thousands to small local societies whose membership may not exceed a score. Nevertheless, as an indication of the extent to which the principle of joint association for mutual benefit prevails among the agricultural community, it is of interest to know that 1,900 organisations of one kind or another exist in Great Britain for the promotion of agriculture.

The following Circular, dated September 24th, 1910, has been addressed to Local Authorities in Great Britain on the subject of Anthrax:—

The Anthrax Order of 1910.

SIR,—I am directed by the Board of Agriculture and Fisheries to forward herewith copies of the Anthrax Order of 1910, which will come into force on January 1st next.

It will be seen from the Annual Reports of Proceedings under the Diseases of Animals Acts that during recent years the Board have been watching anxiously the returns received from Local Authorities as regards anthrax, and I am to call the special attention of your

Local Authority to the Tables in Appendix I. to this letter, which give (1) the number of Counties in Great Britain from which anthrax was reported by Inspectors of Local Authorities, the number of outbreaks reported, and the number of animals returned as attacked in each year, 1887–1909, together with the corresponding figures for the first half of the current year; and (2) the number of outbreaks of anthrax in each county in Great Britain during each year from 1899 to 1909.

It will be observed that since the year 1899, when the Anthrax Order now in force was made, the number of outbreaks of anthrax reported by Inspectors of Local Authorities has steadily increased, until in 1909 the total reached 1,317. The figures available for the first half of the current year show at the same time that a decrease in the number of outbreaks during 1910 is not to be looked for. In his recent reports the Chief Veterinary Officer of the Board has drawn attention to the difficulties met with in regard to diagnosis in anthrax, and has shown there is good reason for the belief that in the past cases have not infrequently been certified as anthrax, when a careful examination by highly skilled specialists has failed to reveal any positive diagnostic evidence of the presence of the disease. It is highly probable that the statistics available are to some extent misleading, and that the real position is not so unfavourable as it would appear to be.

At the same time the position revealed by the returns cannot be regarded otherwise than as unsatisfactory, and the time appears to the Board to have arrived when some further effort should be made to bring the disease under greater control. As anthrax is communicable to man and may prove fatal, and as the disease may be spread by the effusion of the blood of the diseased animal, which may also contaminate for an indefinite period the ground on which it is spilt, it is essential that nothing shall be left to chance in dealing with the carcase of a suspected animal. Experience has shown that in the majority of cases a satisfactory definite diagnosis cannot be made immediately by the veterinary surgeon on the spot. A careful microscopical examination of a sample of the blood of the dead animal is often necessary before a positive diagnosis can be arrived at, and to secure this an interval of time may be necessary. At the same time, unless the veterinary surgeon is satisfied from the history of the case, and an examination of the external lesions of the carcase, or from a microscopical investigation made immediately and on the spot, that anthrax does not exist, it is obviously important that precautions as regards the suspected carcase should be taken forthwith, in order that no avoidable risks shall have been run in the interval, should the suspicion ultimately be confirmed.

The New Order is framed with a view to enable the Veterinary Officers of the Board to examine the evidence upon which the veterinary surgeon acting on behalf of the Local Authority has based his diagnosis, and if necessary to make further experimental investigations, before any reported outbreak is finally accepted as an undoubted case of the disease, and for this an interval of time, which might in some cases extend to several days, is requisite. In these circumstances it is essential that any possible sources of risk should at once be

removed. Accordingly, the new Order provides that in reported cases of the disease, if the veterinary surgeon employed by the Local Authority is not satisfied by his examination on the spot that the case is not one of anthrax, the carcase shall forthwith be destroyed by fire, or, if this is not feasible, buried with the usual precautions, and the place where the carcase has lain or where its blood has escaped should be disinfected at once by the Local Authority in precisely the same manner as if a positive diagnosis of anthrax had already been arrived at. Animals known to have been in contact with the dead animal are also treated temporarily as having been exposed to the risk of infection of anthrax, and kept under detention.

If the veterinary surgeon employed by the Local Authority is satisfied from his examination that anthrax does not exist, the fact is to be communicated to the Board and to the occupier, and the notice of restriction served on him is to be withdrawn by the Local Authority.

Although where the veterinary surgeon is not so satisfied, the carcase is to be destroyed, and the premises are to be treated for the purposes of preliminary disinfection as if the disease were present in that carcase, it is not until the diagnosis has been confirmed by the Veterinary Officers of the Board that the full provisions of the Order as regards the creation of an anthrax-infected place are brought into force. The forms provided by the Board upon which weekly returns as to anthrax are to be made by Inspectors of the Local Authority are only to be used where the existence of disease has been confirmed in the above manner.

The veterinary surgeon, acting on behalf of the Local Authority, in dealing with a case of suspected anthrax is required to take and examine such samples of the blood or other fluid of the animal or carcase, or of the tissue of the carcase as may be necessary for further investigation, and it is contemplated that he should himself arrive at an opinion as to whether or not disease exists and communicate it to the Board in the report he is required to make to them, but he will not embody the opinion in a certificate issued under the Acts. Some notes as to the equipment necessary for veterinary surgeons, the method of taking blood from the carcase of a dead animal, and the preparation of slides for microscopical examination will be found in Appendix II. to this letter. In order to facilitate the business of dealing with these reports and samples, it would be convenient that the specimen form given in Appendix III. to this letter should in all cases be followed by the officers of the Local Authority, to whom the necessary forms should be supplied by the Local Authority. The Board will be glad if your Local Authority will issue such instructions to the veterinary surgeons employed by them as will ensure that the above procedure is carefully carried out in each case.

The Order also provides that the owner of a suspected animal or carcase is at once to be served with a notice calling his attention to the precautions which the Order (Article 3) requires him to take, and that a copy of the notice is to be forwarded to the Board.

In view of the specially dangerous nature of the disease, the Board consider that the responsibility of securing the most thorough disinfection practicable should remain with the Local Authority, and as a

rule it will probably be found more satisfactory that the work should, as heretofore, be carried out by the officers of the Local Authority.

To meet certain cases which have been brought to their notice the Board have, however, in their new Order (Article 14 (2)) empowered the Local Authority to require the occupier or the owner himself to carry out the disinfection at the expense of the Local Authority. Where this procedure is followed the Board would suggest that precise instructions should be given to the owner in writing as to the methods of disinfection to be followed, including a description of those parts of the premises to which they are applied, the disinfectant to be used and the solution thereof, and also the materials and labour to be provided, in order that there may be no misunderstanding in connection with the settlement by the Local Authority of the cost of the disinfection after they are satisfied that it has been thoroughly carried out. Arrangements of this character have been adopted by the Board in connection with their administration of the Swine Fever Order, with satisfactory results.

The Local Authority may, under Article 13 (5) of the Order, recover from the owner of an animal or carcase any portion of the cost of disinfection where that has been increased by his wilful act or neglect.

Having regard to the characteristics of the disease and the extreme importance of the careful use of all possible precautions against injury to human beings or to animals in suspected cases of anthrax, it is to the public interest that any case of illness amongst animals which suggests the possibility of anthrax being present should be placed at the earliest possible moment under the control of a veterinary surgeon employed by the Local Authority concerned. It is only, therefore, in cases where a veterinary surgeon, acting on behalf of an owner of a sick animal, has satisfied himself that neither the history of the case nor any external lesions in the carcase of a dead animal indicate the existence of anthrax, that he would be justified in taking a sample of the blood or other fluid or tissue from such a carcase for the purpose of microscopical examination. In view of the importance of this matter the Board trust that members of the veterinary profession will carefully conform to this view, and thus assist the authorities in their efforts to combat this disease.

In issuing the new Order the Board desire to lay stress upon the fact that anthrax is a disease against which it is not practicable entirely to guard on account of the multiplicity of the channels through which infection may be conveyed. Although the eradication of the disease cannot be aimed at, it is possible to bring it more under control. It is believed that the new Order will be of service in securing the collection of more trustworthy statistics to form a basis upon which to build up any other measures which further experience may indicate as likely to reduce the risk of infection, and the Board are satisfied that they may rely upon the co-operation of the agricultural community in carrying the new arrangements into effect.

I am, Sir, your obedient servant,

T. H. ELLIOTT,

Secretary.

Notice to Purchasers of Gooseberry Bushes.

In consequence of the spread of American Gooseberry Mildew during the summer, the Board of Agriculture and Fisheries recommend all purchasers of gooseberry bushes, from whatever source they are obtained, to examine their purchases very carefully on delivery, to cleanse the plants thoroughly from all earth, and to remove and burn the tips of the shoot before planting. If any trace of disease is found the purchaser should communicate with the Board, and supply full information as to the source from which the consignments were obtained, in order that the matter may be investigated.

Historical Monuments in Hertfordshire.

The first of a series of publications which will prove of great interest to landowners has recently been published by the Royal Commission on Historical Monuments in the form of a Report and Description of the Historical Monuments in the County of Hertfordshire.*

This Royal Commission, which was appointed in 1908, and is presided over by Lord Burghclere, has for its object the preparation of an Inventory of the Ancient and Historical Monuments and Constructions connected with or illustrative of the contemporary culture, civilisation, and conditions of life of the people in England from the earliest times to the year 1700. Hertfordshire was selected as the first of the counties to be investigated, and the Commission is now engaged on a similar work in the County of Buckingham.

The Inventory of Hertfordshire, which is a well-illustrated work of over 300 pages, contains an interesting introduction summarising the history of the county, together with a concise account of each of the ancient constructions, arranged by parishes.

Excellent photographs are given of many of the most interesting churches and houses, with sketch maps of the earthworks and similar remains, and plans of some of the churches, indicating the different periods of construction.

The Commission states that the condition of the monuments of Hertfordshire is, on the whole, good, and that the County Council and the Urban District Councils are alive to the advantage of preserving the ancient monuments in the country. The duties of the Commission itself are limited to recording and describing the monuments and specifying those which seem most worthy of preservation, but it has no power to take any steps for the protection of monuments which are threatened with destruction. Cases, however, occur where it is desirable to deal at once with imperilled monuments of historic importance, and the Commission are of opinion that the time has come when such cases should be dealt with by a Government Department acting with the assistance of a permanent Advisory Board.

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* An Inventory of the Historical Monuments in Hertfordshire. Price 11*s*. 6*d*. To be obtained from Messrs. Wyman & Sons, Fetter Lane, London, E.C. First Interim Report of the Royal Commission: The Ancient Monuments of the County of Hertford. [Cd. 5367. Price 4½*d*.]

IMPORTATION AND OTHER REGULATIONS.

Importation of Animals into Swaziland.—New regulations, dated July 30th, came into force on August 2nd, 1910, in continuation of and in substitution for those already issued in connection with the "Swaziland Disease of Animals Proclamation, 1908." The new regulations prohibit the importation into Swaziland of horses, mules, donkeys, pigs, and dogs without a permit from the Government veterinary surgeon, and also the entry of any cattle from Portuguese East Africa, Transvaal, or Natal (with the exception in the case of Natal of cattle imported for breeding purposes from oversea and accompanied by special permit of the Commissioner). Cattle from the Cape Colony are prohibited unless accompanied by a certificate of health from a Government Veterinary Surgeon. All imported cattle must be subjected to the tuberculin test, and any expense incurred by the Veterinary Department in connection with the examination of animals entering Swaziland must be borne by the person desirous of importing the stock.—(*Board of Trade Journal,* September 8th, 1910.)

Importation of Plants into Mauritius.—The only restrictions hitherto in force in Mauritius with regard to the importation of plants were those placed upon vine plants and cuttings by Ordinance No. 14 of 1882. These restrictions have now, however, been extended to include all seeds, plants, and cuttings, and the Governor of the Colony is empowered by Ordinance No. 4 of 1910 to prohibit by proclamation the importation of all such articles which are likely to introduce disease.

Importation of Animal Products into Sweden.—The Board of Trade are in receipt, through the Foreign Office, of information to the effect that a clause has been added to Section 1 of the Swedish Royal Ordinance of August 6th, 1908, prescribing that unmelted tallow, unmelted suet, chops (jaws), blood and fresh bone of ruminants or swine, used farming or swine-pen appliances, and fodder and litter of hay or straw, may not be imported into Sweden unless accompanied by a certificate, as provided for in Section 3 of the Ordinance, stating that the goods are from a place free of foot-and-mouth disease.

In accordance with Section 3, certificates must be issued by the Swedish Consul or other public official at the port of shipment; but a certificate issued by some other person may be accepted if his good faith be attested by one of the above-mentioned authorities.—(*Board of Trade Journal,* September 29th, 1910.)

Sale of Seeds in Canada.—The Act regulating the inspection and sale of seeds in Canada, passed in 1905 and revised in 1906, and to which reference has already been made in this *Journal,* Vol. XII., January, 1906, has now been amended by a further Act of March 17th, 1910. The amendments prohibit the sale of seeds of cereals, grasses, clovers, forage plants, field roots, or garden vegetable crops which are not capable of germinating in the proportion of two-thirds of the percentage standard of vitality for good seed of the kind, unless the percentage of vitality is clearly indicated on the packages containing the seed. The seeds of such cereals, &c., must be free from Wild Mustard or Charlock (*Brassica sinapistrum,* Boiss.) and Wild Radish (*Raphanus Raphanistrum,* L.), in addition to the weed seeds specified

in the Act of 1905. Where the seeds of timothy, red clover, alsike, and alfalfa are offered for sale as of first quality, certain additional weed seeds are included in the list of those originally prohibited.

Importation of Fertilisers into Morocco.—The Board have received from the Board of Trade a copy of a Moroccan Imperial Decree which permits the importation into Morocco, free of duty, of artificial fertilisers, including phosphates, sulphate of ammonia, and Peruvian guano, and of any other fertilising materials, provided they are not capable of being utilised otherwise than as manures.

Importation of Live Stock from Great Britain into Uruguay.—The Board of Agriculture and Fisheries have been officially informed that the restrictions recently imposed by the Government of Uruguay in the importation of cattle, sheep, goats, and swine from Great Britain have been withdrawn.

German Regulations as to the Importation of Feeding Barley.—The import duty under the German tariff of 1906 is fixed for feeding barley at 13 marks, and for malting barley at 40 marks per metric ton, and in order to prevent malting barley being charged at the lower rate, a law was passed in August, 1909, providing that feeding barley weighing more than 65 kilos. per hectolitre shall only be admitted if it is dyed red by means of "Eosine," or if it is submitted to a thorough analysis showing its unsuitability for malting purposes. The regulation with regard to dyeing has given rise to numerous complaints on the part of German farmers and millers.—[*F.O. Reports, Annual Series, No.* 4521.]

MISCELLANEOUS NOTES.

Agricultural Exhibitions Abroad.

Show of Machinery and Implements at Accra.—The Board of Trade are informed that the Agricultural Exhibition at Accra, Gold Coast, to which reference was made in this *Journal*, July, 1910, p. 326, will now be held on February 24th and 25th, 1911, and not on November 25th and 26th, 1910, as originally intended.—(*Board of Trade Journal,* September 1st, 1910.)

Agricultural Exhibition at Omsk, Western Siberia.—H.M. Consul at St. Petersburg (Mr. A. W. Woodhouse) reports that it is intended in the summer of next year to hold an exhibition of the agriculture, forestry, and industry of Western Siberia at Omsk. The main object of this enterprise, the first of its kind in Siberia, is to acquaint the world with the unlimited resources and increasing productiveness of Western Siberia, and to attract foreign exhibitors interested in Siberian trade. British firms are therefore invited to take part, and, if possible, to combine on the same lines as those which it is expected will be adopted by German and Swedish exhibitors, for the purpose of conjointly erecting a special British pavilion. Foreign exhibits for this exhibition will be admitted free of import duties on condition that the amounts chargeable under this head be temporarily deposited at the customs houses at which the goods arrive on the frontiers, and provided such goods are not sold and do not remain in Russia. (*F.O. Reports, Annual Series,* No. 4370.)

Notes on Agriculture Abroad.

Consumption of Fertilisers in Russia.—According to a report by the United States Consul at Odessa, the "loess" and black earth soils of southern Russia are showing signs of exhaustion where they have been cultivated uninterruptedly, and it is probable that recourse will be largely had in the future to artificial manures. The importation of fertilisers has already reached a considerable amount, as is shown in the following table:—

	1907. Tons.	1908. Tons.	1909. Tons.
Basic slag	72,000	72,000	109,000
Superphosphates ...	44,000	38,000	85,000
Potash salts	20,000	25,000	40,000
Nitrate of soda	17,000	15,000	17,000

It is estimated that the amount of bone meal, superphosphates, and other fertilisers produced in the country in 1909 was 126,000 tons. The increasing price of fertilisers in the markets of the interior is regarded as evidence of their growing use and popularity.—(*U.S. Daily Consular Reports*, Vol. I., No. 39.)

Agricultural Machinery in Egypt.—H.M. Vice-Consul at Alexandria (Mr. E. H. Mulock), in reporting on the trade of that district in 1909 (*F.O. Reports, Annual Series,* No. 4554), draws attention to the fact that considerable progress has been made in the district in the employment of more modern agricultural machinery, such as pumps, grain-cleaning and levelling machines, and there is generally a growing demand for light and simple machinery in almost all processes incidental to agriculture. Cheapness and simplicity in the machinery imported are essential, and duplicate parts should be available. Since coal is relatively expensive, oil engines or steam engines up to a certain size with boilers designed for use with oil fuel, would prove most suitable to local conditions. On the large estates the landowners are showing increased interest in the management of their property. Some have already installed pumping stations of considerable magnitude for irrigation, and others are looking about for labour-saving machinery to enable them to cultivate large areas to better advantage. The majority of the population, however, depends for its support on small holdings of from ½ acre to 5 acres, and, as the lack of roads prevents co-operation, little use has hitherto been made of agricultural machinery. With the making of good country roads, joint ownership of more expensive machinery will be possible.

Importation of Frozen Meat into Austria from South America.—As a result of the high prices of meat which have recently been ruling in Austria, it seems possible that, in the immediate future at least, that country will become a competitor for the frozen meat exports of South America. According to dispatches received from H.M. Consul at Trieste, the Austrian Government have decided to send a commission of delegates to South America to study from a commercial, sanitary, and veterinary point of view the question of the exportation of frozen meat and cattle from Argentina and Uruguay. A temporary "permit" for the importation of 10,000 tons of frozen meat has been granted.

Opening for Artificial Manures in Russia.—H.M. Consul at Kieff

reports that a firm at Lutsk, in the Government of Volhynia, desire to obtain the names of British firms dealing in artificial manures. Communications in this connection should be addressed directly to the British Consulate, Kieff.—(*Board of Trade Journal,* August 18th, 1910.)

Potash Industry in Austria.—The United States Consul-General at Vienna reports that an Austrian syndicate has been formed for the development of the salt deposits near Kalusz in Galicia. The laws of Austria forbid the manufacture of mineral salt by private persons, and the business of the syndicate will therefore be conducted under the form of a Government lease, authorising the manufacture of the salt and its sale to the Government at a fixed price. Existing Government mines will be taken over and extended, and factories will be erected for the production of high percentage potassic salts. The potash mines of Austria have hitherto been little worked, but they are known to be rich in salt, and it is possible that under the new arrangements the industry will enter into competition with the German monopoly.—(*U.S. Daily Consular Reports,* Vol. I., No. 40.)

Opening for Seed Potatoes in Uruguay.—H.M. Vice-Consul at Montevideo (Mr. H. Hall Hall) reports that a firm in that city wish to get into communication with a British firm able to supply British-grown seed potatoes. Communications in this connection should be addressed to the British Consulate-General, Montevideo.—(*Board of Trade Journal,* August 18th, 1910.)

Sale of Cattle at the Palermo Show, Buenos Aires.—Mr. Townley, H.M. Consul at Buenos Aires, reports in a dispatch dated July 19th, 1910, that exceptionally high prices were paid by various cold storage companies at the sale by auction of steers which took place at the Palermo Show at Buenos Aires early in July. Ten Hereford steers averaged £939 each, and five Durham steers £870 each. The La Plata Cold Storage Company bought in all 177 cattle at an average of £152 a head. The object of the companies in paying such prices is stated to be to encourage the breeding of better stock for the slaughter yards, especially among the smaller breeders, with a view to obtaining a larger supply of grain-fed stock in the future. Such high prices as were obtained at the show are not likely to be realised again, as the policy adopted on this occasion was exceptional.

Warsaw Hop Fair.—H.M. Consul at Warsaw (Mr. Clive Bayley) reports that the total supplies of hops offered at the Annual Hop Fair, which was held at Warsaw from September 29th to October 1st, were 581,007 lb., compared with 535,284 lb. in 1909. Prices were unfavourable to local hop-growers, although the crops in the district were estimated at from 25 per cent. to 30 per cent. less than in 1909. Extra fine quality hops realised $14\frac{1}{2}d.$ per lb.; first quality, $9\frac{3}{4}d.$ to $14\frac{1}{2}d.$ per lb., as against $17d.$ to $25d.$ for first quality in 1909; second quality, $5\frac{3}{4}d.$ to $7d.$, as against $9\frac{3}{4}d.$ to $15\frac{1}{2}d.$ in 1909; and third quality, $3\frac{1}{2}d.$ to $4\frac{1}{4}d.$, as against $5\frac{3}{4}d.$ to $7d.$ in 1909. The total sales were about 244,800 lb., compared with 333,504 lb. in 1909. The quality of the hops had been adversely affected by the unfavourable summer; the supplies of fine and extra fine grades were very small, while much of the lower grades were brown in colour. There was little demand at the Fair for these lower qualities, and they formed the bulk of the unsold supplies.

Sale of Machinery through Peasants' Credit Associations in Russia.—Some details as to the peasants' credit associations in Russia are given in a report by H.M. Vice-Consul at Kharkoff (Mr. C. Blakey). It is stated that these associations are becoming an important factor in the economic life of the country by raising the peasants' standard of living. The members' deposits amount to £5,300,000, and the annual turnover at £21,000,000. The associations have a liberal bank credit; they give loans for the purchase of land, cattle, and implements, or for the building of houses, and they advance money on grain. In the trade in seeds, artificial manures, agricultural implements, roof iron, and ironmongery, they are likely to supplant to some extent the Zemstvos. At present the associations cannot purchase on their own account, but only on account of individual members who may be helped by the joint credit; the associations can sell on commission, however, and they obtain goods from factories willing to send such goods on commission, and return those unsold. The disadvantages in connection with these arrangements for purchasing goods are that the individual members cannot see the machinery, &c., before purchasing, and the manufacturers have not sufficient confidence as to the safety of their wares to send large quantities of goods for sale on commission. To obviate these disadvantages, the Ministry of Agriculture have drawn up a form of general contract, by signing which firms on the one side and associations on the other enter into reciprocal obligations which control any transactions between signatories with regard to agricultural machinery transactions. According to an investigation made by the Ministry, the number of associations which could accept agricultural machinery and the estimated number of implements which could be sold in each year between February and September are as follows:—

Implements.	Association which could accept machinery.	Fstimated number of implements which could be sold.
Ploughs	433	22,514
Harrows, cultivators	108	1,702
Sowing machines	183	2,672
Harvesting machines	182	4,405
Mowers	29	675
Horse rakes	18	382
Threshers	140	1,046
Winnowing machines	287	5,525
Chaff cutters	90	1,153

There are a few rich credit associations which own money independently of the members' deposits, which they are permitted to use for speculative trading. Such associations, as, for instance, those in Berdiansk and Melitopol, do a large trade, and purchase for their own account machinery, both for cash and on credit. (*F.O. Reports, Annual Series,* No. 4537.)

The following preliminary statement shows the estimated total produce and yield per acre of the corn, pulse, and hay crops in Great Britain in the year 1910, with comparisons for 1909, and the average yield per acre of the ten years 1900–1909:—

Produce of Corn, Pulse and Hay Crops.

Crops.		Estimated Total Produce.		Acreage.		Average Estimated Yield per Acre.		Average of the Ten Years 1900–1909.
		1910.	1909.	1910.	1909.	1910.	1909.	
		Quarters.	Quarters.	Acres.	Acres.	Bushels.	Bushel.	Bushels.
Wheat	England	6,673,023	7,285,506	1,716,629	1,734,236	31·10	33·61	31·47
	Wales	138,912	138,980	39,428	39,575	28·19	28·09	26·64
	Scotland	252,969	255,811	52,801	49,679	38·33	41·19	39·24
	Great Britain.	7,064,904	7,680,297	1,808,858	1,823,490	31·25	33·69	31·55
Barley	England	6,088,727	6,340,580	1,449,492	1,379,133	33·60	36·78	33·15
	Wales	355,930	339,839	87,569	85,272	32·52	31·88	31·13
	Scotland	830,534	936,901	191,624	199,981	34·67	37·48	35·65
	Great Britain.	7,275,191	7,617,320	1,728,685	1,664,386	33·67	36·61	33·34
Oats	England	9,876,317	9,763,873	1,857,731	1,839,912	42·53	42·45	41·84
	Wales	979,591	876,457	205,093	198,528	38·21	35·32	34·59
	Scotland	4,628,333	4,737,867	958,142	943,437	38·64	40·18	37·14
	Great Britain.	15,484,241	15,378,197	3,020,966	2,981,877	41·00	41·26	39·90
Beans	England	1,032,347	1,070,238	256,522	301,287	32·20	28·42	29·62
	Wales	4,896	4,531	1,363	1,347	28·74	26·91	26·52
	Scotland	46,447	42,411	9,493	9,172	39·14	36·99	35·11
	Great Britain.	1,083,690	1,117,180	267,378	311,806	32·42	28·66	29·83
Peas	England	496,598	546,064	151,823	168,673	26·17	25·90	27·25
	Wales	1,946	1,934	660	708	23·59	21·86	21·60
	Scotland	2,114	2,119	566	602	29·88	28·15	27·08
	Great Britain.	500,658	550,117	153,049	169,983	26·17	25·89	27·21
		Tons.	Tons.			Cwt.	Cwt.	Cwt.
Hay from Clover, Sainfoin, etc.	England	2,366,419	2,090,595	1,485,573	1,449 286	31·78	28·85	29·80
	Wales	248,796	192,907	169,939	170,497	29·28	22·63	24·75
	Scotland	669,164	652,589	419,067	415,990	31·94	31·38	32·42
	Great Britain.	3,278,379	2,936,091	2,074,579	2,035,773	31·61	28·84	29 87
Hay from Permanent Grass.	England	5,441,735	4,731,088	4,295,832	4,094,162	25·33	23·11	24·09
	Wales	605,886	484,687	545,109	529,567	22·23	18·31	19·48
	Scotland	225,589	216,585	163,503	152,965	27·59	28·32	29·65
	Great Britain.	6,273,210	5,432,360	5,004,444	4,776,694	25·07	22·75	23·78

Note.—The estimated yield of wheat this year is nearly 2½ bushels per acre less than in 1909, and about half a bushel less than the average of the previous decade. The total production of wheat, while less than last year by about 600,000 quarters, is above the ten years'

average, mainly in consequence of an increase of acreage in recent years. Barley is slightly above an average yield in Great Britain, notwithstanding a deficiency of one bushel per acre in Scotland, but it is less than in 1909 by three bushels per acre. Oats are the most satisfactory of the corn crops with a yield per acre of over one bushel above average. Beans are well above average and still more above the previous year's return. The hay crop, both from arable and meadow land, is above the average by nearly 2 cwt. per acre in the one case and $1\frac{1}{4}$ cwt. in the other. Altogether over $9\frac{1}{2}$ million tons of hay were grown this year as compared with less than $8\frac{1}{2}$ million tons in 1909. The average annual production is about 9 million tons.

The estimates for the potato and root crops are collected at a later date than those for corn, pulse, and hay, and will be issued subsequently.

Report on Agricultural Conditions on November 1st.

Most of the Crop Reporters of the Board, in reporting on the state of the crops and the agricultural conditions on November 1st, state that the quality and condition of wheat and oats harvested this year was generally regarded as fairly satisfactory, but, on the other hand, some Reporters refer to the condition as poor, or even bad. In many districts the quality of barley is reported as poor and inferior; much is discoloured and weather-stained, and good malting samples are often scarce. The crop appears to be somewhat better in Scotland, but even there is not generally satisfactory. The official returns of the quantities of grain produced in Great Britain show that the total production of wheat was 7,064,904 qrs., or 31·25 bushels per acre, which is about half a bushel below the ten-years' average. The yield was relatively least satisfactory in East Anglia and the extreme south-east, but above the average, generally, in the Midlands, North of England, and Wales; Scotland's yield was nearly a bushel below average. The average yield of barley, 33·67 bushels per acre, was just one-third of a bushel above the average, the total for Great Britain being 7,275,191 qrs. As in the case of wheat, the smallest crops were in the east and south-east of England, and in the east of Scotland, the rest of the country being as a rule well over average. The total yield of oats, 15,484,241 qrs., or 41 bushels per acre, was practically 1 bushel over average; the Welsh yield being no less than $3\frac{1}{2}$, and the Scotch $1\frac{1}{2}$, bushels over average; again, the eastern side of the country was less satisfactory than the western.

Beans yielded 1,083,690 qrs., or 32·42 bushels per acre, which is $2\frac{1}{2}$ bushels above the average; of the more important counties, only the East Riding of York and Sussex were seriously deficient. Peas, on the other hand, proved deficient by 1 bushel per acre; the total production being 500,658 qrs., or 26·17 bushels per acre.

The corn harvest in Scotland, which had not been completed at the date of the last report, was generally finished during the first fortnight of October, having been favoured by good weather, though in the more northern districts it was about a week later.

Potato-lifting has very generally been completed in England, and the bulk of the crop has been secured in Scotland. The damage caused

by disease, although severe in many places, does not appear to have increased so much as was anticipated from the appearance of the crop a month ago. Where free from disease, the tubers are generally reported to be in good condition.

October has generally suited the root crops, turnips and swedes having made considerable growth during the month. Turnip-lifting had hardly commenced, but the crop is reported to be a good one. Storing of mangolds was well advanced in the southern half of England, and perhaps even more so in the north. This crop, though probably above average, will hardly prove so good as turnips, statements that the roots are small being numerous.

Good progress has been made with autumn cultivation, timely rains in October having sufficiently softened such land as was too hard to work in September. In some districts in the south and east, and even in some parts of the northern counties of England, wheat sowing is practically finished, and elsewhere it is well advanced.

The official returns of the yield of hay in 1910 are as follows:—From clovers and rotation grasses, 3,278,379 tons, or 31·61 cwt. per acre ($1\frac{3}{4}$ cwt. above average); from permanent grass, 6,273,210 tons, or 25·07 cwt. per acre ($1\frac{1}{4}$ cwt. above average). The yield has been particularly abundant in Wales, while the east and south of England have also realised heavy yields. In Scotland, where the weather was relatively drier, the production is below the average, particularly in the case of permanent grass.

"Seeds" for mowing or grazing next year have generally done well during October. Store cattle and ewes are thriving everywhere, though foot-rot among sheep is mentioned occasionally. Keep is generally plentiful.

Notes on the Weather in October.

During the *first* week, October 2nd to October 8th, the weather over Great Britain generally was fair to fine. Sunshine exceeded the normal, and in some places the temperature was 6° above the average; warmth being classed as "very unusual" over the whole of Scotland and in England E. and N.E., and "unusual" elsewhere. Rainfall was much below the average, a light fall being recorded all over the country, except in Scotland N. and W.

The conditions during the *second* week were not so good, and were generally much finer in Scotland and the northern districts of England than in the more southerly counties, where heavy rain occurred in the middle and latter portions of the week. Warmth continued "unusual" in the eastern districts of England and in the Midland counties, but was "moderate" over the rest of the country.

At the beginning of the *third* week the weather was fair and dry in the northern and eastern parts of Great Britain, but later the conditions became unsettled everywhere. Rainfall was "heavy" in England S.E. and N.W. and Scotland E., and "moderate" elsewhere, except in Scotland N. Warmth still continued "unusual" in England E. and N.E., and was above the average in all other districts except the extreme south. The bright sunshine recorded was, however, very deficient over the whole of Great Britain.

The weather during the *fourth* week was fairly dry over most of the

country, the rainfall recorded being "light," or "very light" everywhere except in the Southern and Midland counties. Though rain was generally absent, the weather was cloudy and the sunshine was either "scanty" or "very scanty," except in the north of Scotland. The spell of unusual warmth which had been experienced in the easterly and north-easterly districts of England since the beginning of the month still continued. Warmth was also "unusual" during this week over the rest of England, except in the Midland counties, where it was only "moderate."

Produce of Hops.

The Board of Agriculture and Fisheries have issued the following preliminary statement, dated October 19th, showing the estimated total production of hops in the years 1910 and 1909, with the acreage and estimated average yield per statute acre in each county of England in which hops were grown.

Counties, &c.	Estimated Total Produce.		Acreage Returned on 4th June.		Estimated Average Yield per Acre.	
	1910.	1909.	1910.	1909.	1910.	190
	Cwt.	Cwt.	Acres.	Acres.	Cwt.	Cwt.
Kent ... East ...	49,135	34,861	5,779	5,711	8·50	6·10
Kent ... Mid... ...	64,874	58,283	6,942	6,724	9·34	8·67
Kent ... Weald ...	72,886	62,600	7,357	7,201	9·91	8·69
Total, Kent	186,895	155,744	20,078	19,636	9·31	7·93
Hants	16,946	9,444	1,411	1,414	12·01	6·68
Hereford	40,961	14,966	4,987	4,997	8·21	2·99
Surrey	5,341	2,344	514	544	10·38	4·31
Sussex...	22,878	15,785	2,653	2,775	8·62	5·69
Worcester	28,666	16,123	3,109	3,054	9·22	5·28
Other Counties* ...	988	78	134	119	7·37	0·66
Total ...	302,675	214,484	32,886	32,539	9·20	6·59

* Gloucester and Salop.

NOTE.—The estimated average yield of 9·20 cwt. per acre this year, although larger by over 2½ cwt. than that of 1909, is smaller than that of 1908 by nearly 3 cwt. The wide differences in the yield of successive seasons renders comparison with an average crop somewhat difficult, but—following the system adopted by the Board in all crop returns since the institution of official estimates in 1885—the average of the preceding decade is adopted as the basis for comparison. The average yield of the ten years 1900–9 was 8·71 cwt. per acre, so that the yield per acre for 1910 is rather more than 5 per cent. above an average. On the other hand the total crop, though larger by 88,000 cwt. than in 1909—owing partly to a slight increase of acreage but mainly to the increased yield per acre—is smaller by 99,000 cwt., or nearly 25 per cent., than the average total crop of the preceding ten years.

Notes on Crop Prospects Abroad.

The International Agricultural Institute at Rome, in its Bulletin of Agricultural Statistics issued on October 20th last, gives particulars of the wheat, barley, rye, and oat crops for 1910 in the principal countries of the Northern Hemisphere. The results may be modified to some extent when the final returns have been received, but the figures available up to the present, as will be seen from the tables given below, show that the area under wheat in twenty countries in the Northern Hemisphere in 1910 was larger by 6·2 per cent. than that of last year, while the production was greater by 3·9 per cent. The area under rye decreased in fourteen countries by 0·6 per cent., but the crop was larger by 3·3 per cent. The area under barley and oats increased by 2·7 and 2·6 per cent. respectively, but while the barley crop was larger by 1·4 per cent., that of oats decreased by 3·7 per cent. (The figures for barley refer to fifteen countries and those for oats to fourteen countries.) The returns, as regards wheat, represent probably some seven-eighths of the total production in the Northern Hemisphere, but in the case of the other crops, returns are still required from several important countries, and when these are received they may possibly affect the percentages given above. So far as the information available at the time of publication of this Bulletin showed, it appeared that the production of the two principal food-grains, viz., wheat and rye, would be somewhat greater than that of last year. The variation in the yield of barley was unimportant, but there was a decline in the oat crop.

Country.	Area and Production in 1910 as compared with 1909.							
	Wheat.		Rye.		Barley.		Oats.	
	Area.	Production.	Area.	Production.	Area.	Production.	Area.	Production.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent
Prussia ...	108·2	105·5	100·8	96 0	94·6	80·9	99·3	87·4
Bulgaria ...	105·9	153·2	111·7	169·7	101·9	169·0	99·2	141·0
Denmark ...	98.1	106·7	99·6	99·2	99·7	91·5	99·2	90·3
Spain	101·4	94·9	99·9	91·2	97·8	102·9	104·1	89·6
France ...	98·9	73·5	101 0	86·1	—	—	—	—
Great Britain ...	99·2	91·3	—	—	103·9	93·6	101·3	95·8
Hungary ...	108·6	157·6	106·1	116·8	102·5	87·4	101·6	84·1
Italy	101·0	80·7	100·0	108·1	99·1	86·6	100·0	65·8
Luxemburg ...	110·0	122·5	99·7	106·4	—	—	—	—
Netherlands ...	104·1	105·1	98·6	84·1	99·3	101·9	98·7	96·1
Roumania ...	115·3	188·3	127·3	248·1	100 0	143 4	92·2	109·5
Russia in Europe ...	93·2	115·4	98·0	106·2	92·3	112 6	100 2	95·3
Sweden ...	97·3	96·3	96 5	91·4	—	—	—	—
Switzerland ...	100·0	95 8	100·0	98·6	100·0	97·1	—	—
Canada ...	119·9	73·6	92·1	95·3	98·3	71 1	106·0	80·1
United States .	104·4	93·8	—	—	100·7	92·9	103·5	106·5
British India ...	106·9	126·0	—	—	—	—	—	—
Japan	100·6	99·1	—	—	—	—	—	—
Russia in Asia .	212·9	133·3	118·1	125·2	602·0	131·6	121·0	131·3
Tunis	89·0	85·7	—	—	88·1	72·5	103·3	98·7
Average ...	106·2	103·9	99·4	103·3	102·7	101·4	102·6	96·3

AREA AND PRODUCTION OF CEREALS IN 1910.

Country.	Wheat.		Rye.		Barley.		Oats.	
	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.
	1,000 acres.	1,000 cwts.	1,000 acres.	1,000 cwts.	1,000 acres.	1,000 cwts.	1,000 acres.	1,000 cwts.
Prussia ...	2,833	47,021	11,659	161,341	2,066	30,817	6,929	104,104
Bulgaria ...	2,721	26,310	556	5,860	610	6,750	482	3,768
Denmark ...	99	2,155	679	9,443	576	9,128	988	12,972
Spain ...	9,470	73,270	2,057	15,902	3,403	35,963	1,277	8,778
France ...	16,114	141,347	3,060	23,968	—	—	—	—
Great Britain	1,808	30,031	—	—	1,728	25,460	3,020	41,009
Hungary ...	9,520	106,300	3,039	29,678	3,089	27,991	2,990	23,687
Italy	11,754	82,123	301	2,719	612	4,063	1,243	8,162
Luxemburg...	30	405	26	349	—	—	—	—
Netherlands .	132	2,316	546	7,406	70	1,449	345	5,815
Roumania ...	4,812	59,373	429	3,828	1,357	12,684	1,104	8,717
Russia in Europe ...	53,142	440,137	68,195	466,117	24,167	225,942	41,606	291,069
Sweden ...	222	3,566	963	11,405	—	—	—	—
Switzerland ..	105	1,830	60	984	13	197	—	—
Canada ...	9,291	65,759	84	817	1,833	16,876	9,860	85,961
United States	48,767	370,486	—	—	7,054	67,754	34,367	313,168
British India .	27,828	191,254	—	—	—	—	—	—
Japan ...	1,115	11,809	—	—	—	—	—	—
Russia in Asia	17,892	51,314	2,825	12,328	4,273	5,035	5,724	29,175
Tunis ...	889	2,952	—	—	1,000	2,853	153	1,535
Total ...	218,544	1,709,758	94,479	752,145	51,851	472,962	110,088	937,920

Argentina.—The Minister of Agriculture, in an estimate dated October 18th, gives the acreage under wheat in 1910 as 15,451,000 acres, compared with 14,418,000 acres in 1909. The acreage under oats is estimated at 1,979,000 acres, compared with 1,417,000 acres in 1909. Light rains are reported in the northern zone, which have greatly benefited the crops. (*Times,* October 20th.)

France.—The acreage and production of the barley and oats crops is estimated by the French Ministry of Agriculture as follows:—

	1910.		1909.	
	Area.	Production.	Area.	Production.
	Acres.	Bushels.	Acres.	Bushels.
Barley	1,842,000	43,156,000	1,814,000	44,718,000
Oats	9,668,000	305,393,000	9,699,000	320,947,000

United States.—The Crop Reporting Board of the Department of Agriculture finds that the preliminary returns of the production of maize in 1910 indicate a total yield of about 3,121,381,000 bushels (an average of 27·4 bushels per acre, compared with 25·5 bushels in 1909). The indicated yield of buckwheat is 17,084,000 bushels, compared with 17,438,000 bushels in 1909 (an average of 20·9 bushels, compared with 20·8 bushels in 1909). The total yield of potatoes is estimated at 328,787,000 bushels, against 376,537,000 bushels last year, the average yield per acre being 93·4 bushels per acre, compared with 106·5 bushels in 1909, and a ten-year average of 91·5 bushels.

Canada.—The Bulletin issued by the Canadian Census and Statistics Office in October states that the percentage condition of cereals at the end of September was as follows:—Spring wheat, 81·59; oats, 83·84; barley, 80·09; rye, 83·59. Except in the case of rye, the condition indicated by these figures is not so good as on the corresponding date in 1909. This is due to a decreased estimate for the North-West Provinces, where the quality is some 20 per cent. below that of last year. The estimated yield of rye is 1,634,100 bushels.

Potatoes in Sweden.—H.M. Consul at Stockholm states that according to the official report presented to the Swedish Agricultural Committee, the condition of the potato crop at the end of September may be represented numerically as 3·4 (4=good, 3=moderate). The condition of the crop is best in the northerly districts; in other parts disease is more or less prevalent. In general, the quality is said to be bad, and it is anticipated that there will be a demand for foreign potatoes during the winter and spring.

Potatoes in Germany.—The condition of the potato crop in Germany in the middle of October, as estimated by the Imperial Statistical Bureau, was stated numerically to be 2·9 (2=good, 3=average), or just above the average. In the western, southern, and central districts the crop was under average or small, and in the northern and eastern districts the condition was generally only slightly above average. The Report of *Landwirtschaftsrat* for November 1st gives the yield as 87·5 per cent. of a normal crop as compared with 94·8 at the same date last year. Of these 8·9 per cent. were diseased.

Hop Yield in Germany.—The German Imperial Statistical Bureau, in a report dated October 10th, estimates the yield of hops in the German Empire in 1910 as 402,000 cwt., as compared with 119,000 cwt. in 1909, and 518,000 cwt. in 1908. The acreage under this crop in 1910 is stated to be 68,000 acres, as against 72,000 acres in 1909, and 89,000 acres in 1908.

Hungary.—The maize crop prospects have improved slightly, the yield being estimated by the Hungarian Ministry of Agriculture on October 9th at 22,500,000 qrs. The potato crop has suffered a good deal, and the previous estimate was further reduced to 4,547,000 tons, but the yield is on the whole considered to be a medium one.

Russia.—H.M. Acting-Consul-General at Odessa (Mr. H. E. Dickie) stated that, according to the official report in the *Commercial Gazette* of September 21st, the hopes entertained earlier in the year of a record harvest were not realised. Taken as a whole, the final results of the grain crop of European Russia were barely average as to quantity and rather below the average as to quality. The yields of winter and spring wheat are reported to be just above the average, while the rye, oats, and barley are only medium.

In connection with the above, it may be of interest to note that the *Commercial and Industrial Gazette* of October 23rd contains figures of the estimated winter-sown wheat and rye crops in 73 Governments (Provinces) of Russia, issued by the Central Statistical Committee on October 22nd, as follows:—

	Winter Wheat. Tons.	Winter Rye. Tons.
Average yield, 1904–8...	5,381,000	19,445,000
Actual yield, 1909	5,661,000	21,930,000
Estimated yield, 1910	6,611,000	21,189,000

Hop Crop of Oregon and Washington.—H.M. Consul at Portland, Oregon (Mr. James Laidlaw), in reporting on the production of hops in that district, states that the quality of Oregon hops is superior and that care is being exercised to pick clean. The production of dried hops is generally estimated at 90,000 bales (185 lb. each), or a little more in Oregon, and at 17,500 to 20,000 bales in Washington.

Soy Bean Crop of Manchuria.—The British Acting Consul-General at Mukden (Mr. R. Willis) has telegraphed to the effect that the bean harvest in Southern Manchuria is excellent, and that harvest prospects in Northern Manchuria are from 20 to 30 per cent. better than last year, the beans also being of a very much better quality. (*Board of Trade Journal,* November 3rd.)

Agricultural Labour in England during October.

Employment was generally regular, though day labourers in parts of the Southern and South-Western Counties lost a little time in the middle of the month through rain. There was a fairly good demand on the whole for such men for threshing, lifting potatoes and the root crops, and other seasonal work, but the supply was sufficient.

Northern Counties.—With the exception of *Northumberland,* where there was little demand for day labourers, correspondents in these counties generally reported a fairly good and constant demand for men of this class, and an equal supply of labour. Men were chiefly wanted for taking up the potato, mangold, and turnip crops, hedging, threshing, and manure carting.

Midland Counties.—Outdoor work was generally regular in these counties. A moderate amount of extra labour was required for work on the potato and root crops, threshing, &c.; the supply, however, was generally ample, and was somewhat in excess of requirements in the Tamworth (*Staffordshire*) Rural District, and in parts of *Northamptonshire, Oxfordshire,* and *Buckinghamshire.*

Eastern Counties.—There was a fairly good demand for day labourers on account of potato-lifting, threshing, and other seasonal work, and few men were reported as being in irregular employment. There was, however, a small surplus of such men in the Henstead (*Norfolk*) and Thingoe (*Suffolk*) Rural Districts. A scarcity of men for potato-lifting was reported in the North Witchford (*Cambridgeshire*) Rural District, and more day labourers than could be obtained were wanted in the Spilsby (*Lincs.*) Rural District.

Southern and South-Western Counties.—Employment was generally regular, but in a number of districts day labourers employed at threshing lost a little time in the middle of the month through rain. There was a fair demand for day labourers, which was met by about an equal supply in most districts. Some surplus was reported in the Westbury and Whorwellsdown (*Wiltshire*) Rural District, and in certain districts in *Hampshire,* while a shortage in the supply was reported in the Godstone (*Surrey*) and Tisbury (*Wiltshire*) Rural Districts. Men for permanent situations were somewhat scarce in the Godstone (*Surrey*) and Stow-on-the-Wold and Wotton-under-Edge (*Gloucestershire*) Rural Districts, and a demand for stockmen was reported in the Chippenham (*Wiltshire*) Rural District.

THE CORN MARKETS IN OCTOBER.

C. KAINS-JACKSON.

Favourable weather for threshing caused the October markets to be well supplied with new barley and fairly well supplied with new wheat. For reasons not very easy to determine, the offers of new oats have been below the average. Importation of maize has been heavy, fair of wheat and barley, small of oats and flour. Mild weather has enabled cattle to be kept in the fields longer than usual, and has reduced the demand for dry feeding-stuffs. Bakers assert that the sales of bread have likewise witnessed to the effect of a clement season.

Wheat.—The average price of English has been, for the two completed months of the new cereal year, 30*s.* 8*d.*, as compared with 33*s.* for the like two months of 1909. It is not though likely that this decline of 2*s.* 4*d.*, albeit somewhat serious, will affect the autumn sowings much. The crops of 1911 will determine the selling price presumably of wheat now sown, and the cereal year now in progress will have run its course before the autumn sowings of 1910 are in material market supply. When, however, value gets close down to thirty shillings a feeling of anxiety is set up, and after two or three autumns marked in succession by this lowness of price a general movement towards replacing wheat by some other crop in the rotations is started. Farmers express themselves apprehensive of the recent rate of Russian and S.E. European wheat exports being repeated in future autumns, but the information at the disposal of the markets does not extend to any knowledge justifying a forecast one way or the other. These exports for October were 3,942,000 qrs. from Russia, and 1,954,000 qrs. from Roumania, while 204,000 qrs. additional are credited to ports of Europe S.E. outside the Roumanian. The quantity on passage to the United Kingdom on October 31st was very small in proportion, namely, 405,000 qrs. from Russia, and 185,000 qrs. from Europe, S.E.,* but the Continental demand taking the great bulk of such shipments has the effect of making the New World and India unusually dependent on a single customer—Great Britain. Buyers at Mark Lane have consequently been able to get Russian wheat at 2*s.* decline on the month, Indian at 1*s.* reduction, and American at various concessions. Manitoba has come down to 38*s.* for fine quality. The shipments of October other than those already given were:—North America, 726,000 qrs.; South America, 463,000 qrs.; India, 491,000 qrs.; and Australasia, 285,000 qrs. At the end of the month 2,240,000 qrs. were on passage from all sources, a trivial change from the end of September, but 878,000 qrs. in excess of the quantities a year ago.

* This expression has come into general use among statisticians, merchants and importers as indicating in a convenient form the following group of countries: Roumania, Servia, Bulgaria, Roumelia, Macedonia, Albania, Epirus, Montenegro and Greece. The term is not limited to shipments other than Russian coming through the Dardanelles, for it includes Aegean and Adriatic Ports. On the other hand it does not include Bosnia Herzegovina and Dalmatia, which are treated as integral portions of the Austro-Hungarian Empire. The Turkish authorities make no returns.

Flour.—Looking over the prices quoted in the review of September as prevailing on the 30th of that month, not one item is found to have changed thirty-one days later. Millers, however, have not had good markets, bakers have purchased reluctantly, and November began with an apprehension of lower prices having to be accepted soon. The arrival of severe weather, it was felt, might remove all need to take less money, while a continuance of October mildness would clearly render it necessary. The receipts of American flour since harvest have been uncommonly light, but there are increased arrivals of Central European. America in October shipped 617,000 sacks, and 248,000 sacks were on passage on the 31st. There will, therefore, in the ordinary course of trade, be increased offers of American flour during the next few weeks.

Barley.—The important exhibitions of new malting barley at Blandford on the 12th, and at Islington on the 15th, failed to produce as good a show as had been hoped for. At Islington the West Country barley obtained the championship for the third year in succession. At Mark Lane the samples shown on the 24th and 31st were more encouraging; some lots were priced at 38*s*., and were of the best bright ale type. There have been good supplies of what is called "bold" or "robust" poultry barley, grain weighing 448 lb. to the quarter, but lacking the thin skin of true malting, and showing, when cut transversely, those small maculations which affect injuriously the eventual colour of the ale. This barley, at 25*s*. to 26*s*. per qr., can only pay if a large yield to the acre be secured; such yields, however, are not rare. The cheap feeding barley of Eastern Europe has continued to find buyers at 18*s*. or thereabouts. Russia in October shipped 3,045,000 qrs., Europe S.E. 322,000 qrs. Since September 1st 315,000 qrs. of Californian brewing barley have been shipped, and of the 630,000 qrs. of barley on passage on the 31st, 340,000 qrs. were Californian. Other shipments were 250,000 qrs. of Russian, &c., and 40,000 qrs. of Anatolian and North African.

Oats.—Great disappointment has been experienced over the quality of the new corn shown at Mark Lane, Peterborough, Chelmsford, and other leading markets. Whether farmers are keeping back their good oats remains to be seen, but some very low averages, many below 16*s*., several below 15*s*., and four below 14*s*. per 312 lb., have been recorded at the statute markets. Cheap foreign (304 lb.) oats have been offered at 13*s*. 6*d*. to 14*s*., whether Argentine or Russian in origin. Demand has been poor. Shipments for October were 162,000 qrs. from La Plata, 1,118,000 qrs. from Russia, and 78,000 qrs. from Europe S.E. The supply on passage on the 31st, 350,000 qrs., was rather above the average.

Maize.—The United States are credited with securing a large and fine crop, the husking of which is now in progress. Prices for January delivery in London opened on the 3rd at 22*s*., fell by the 17th to a guinea, and closed on the 31st at a sovereign. These quotations, though what are known as "futures," must be distinguished from what is called "the speculative market," for the buyers want the corn and will take delivery. A certain amount of speculation has also prevailed, but not much. Argentine maize has become difficult to place

owing to the expectation of ample supplies of American in the first four months of 1911. Maize shipments for October were 354,000 qrs. from the United States, 2,254,000 qrs. from La Plata, 27,000 qrs. from Russia, and 76,000 qrs. from Europe S.E. On the 31st 1,115,000 qrs. were on passage.

Oilseeds.—Very high prices have continued to rule in this branch of trade, but the offers of new Egyptian cottonseed for January shipment are now liberal, and the new linseed of Argentina was quoted on the 31st at 61s. for February delivery, against a spot price for old linseed just ten shillings higher. Imports of linseed, January 1st to October 31st, have been smaller than last season, and stocks are low. Supplies on passage on the 31st were 28,000 qrs. of linseed, 20,000 qrs. of rapeseed, and 39,000 tons of cottonseed.

Various.—A large if not a record production of sugar-beet is spoken of at Mincing Lane, the German, Austrian, Hungarian, and Russian yields all being reported as above an average. Prices, therefore, have fallen rapidly, and the month, which opened with 11*s.* obtainable, closed with 9*s.* per cwt. accepted. Rice has been firm at 7*s.* 6*d.* per cwt. for ordinary "feeding" cargoes. Japan has already become the free buyer anticipated last month. A remarkable fall in the price of red cloverseed has occurred. The English crop appears to be both larger and finer than anticipated, while Chile has entered the field with free offers at £3 per cwt. The month witnessed at its close new English Dun peas selling at 32*s.*, new English winter beans at 30*s.* 6*d.*, new Essex rye at 25*s.*, and good North Cambridgeshire mustardseed at 80*s.*, all per quarter.

THE LIVE AND DEAD MEAT TRADE IN OCTOBER.

A. T. MATTHEWS.

Fat Cattle.—The clearing off of grazing stock in only middling condition and the great influx of chilled beef had the effect of reducing the average prices of all breeds to the following extent:—Shorthorns, $3\frac{3}{4}d.$, $3d.$, and $2\frac{1}{4}d.$ per 14 lb. for first, second, and third qualities; Herefords, $4d.$ and $2\frac{3}{4}d.$ for first and second qualities; Devons, $5d.$ and $2\frac{1}{2}d.$; and Welsh Runts, $3\frac{1}{2}d.$ and $4\frac{3}{4}d.$ The following are the actual averages for the month:—Shorthorns, 8*s.* $4\frac{1}{2}d.$, 7*s.* $6\frac{3}{4}d.$, and 6*s.* $7\frac{3}{4}d.$; Herefords, 8*s.* 7*d.* and 7*s.* $11\frac{1}{4}d.$; Devons, 8*s.* $7\frac{1}{2}d.$ and 7*s.* $9\frac{1}{2}d.$; Welsh Runts, 8*s.* 4*d.* and 7*s.* 7*d.*, and Polled Scots 8*s.* 6*d.* and 7*s.* $11\frac{3}{4}d.$ per stone. These figures refer to English markets only.

The records for the last week of Shorthorn values in twenty English markets presented some remarkable variations, and point, even more emphatically than those of September, to the conclusion that the decline in average values of British beef during the autumn is chiefly owing to the defective system of feeding pursued at that season. The Ipswich official report stated that prime beasts were scarce and dear, making up to 9*s.* 9*d.* per stone. The price of first quality Shorthorns was 9*s.* 6*d.* in that market, and 9*s.* at Lincoln and Norwich. Against these prices we find that 8*s.* was the top price at Bristol, Newcastle, Nottingham, and Wakefield, the general English average for that week being 8*s.* $4\frac{1}{2}d.$ The reward for good feeding, therefore, appears

to have been from 6*d.* to 1*s.* per stone, and as the gain in weight would balance the extra cost of artificials, a handsome margin of profit would be left.

Veal Calves.—Fat calves maintained steadily the average values of September, except in the second week, when they declined $\frac{1}{4}$*d.* per lb., but this was subsequently recovered. In twenty English and Scotch markets the average was again 8$\frac{1}{2}$*d.* and 7$\frac{1}{2}$*d.* per lb. for first and second quality.

Fat Sheep.—The sheep markets have again been remarkably steady from week to week, and the fluctuations in values very small. In fact, the weekly averages have scarcely changed at all, and those for "Downs" were 8*d.*, 7*d.*, and 5$\frac{1}{2}$*d.* for the three qualities, exactly the same as in September. Longwools in fourteen English markets averaged 7$\frac{1}{4}$*d.*, 6$\frac{1}{2}$*d.*, and 5*d.*, this breed also showing no change. In Scotland the Cross-breds have averaged about $\frac{1}{2}$*d.* per lb. more than the Downs in England. The quotations for first quality Downs at Islington have stood rather high relatively to other markets, and in the last week that market was the highest in England for that class of sheep, except Basingstoke, where there would naturally be Southdowns on offer. The chief reason for this is perhaps worth a reference. There have been fairly good supplies of Hampshire Down tegs about nine months old, and weighing from 60 to 68 lb., dead weight. These young sheep were in keen demand, and were, without question, the best quality of Downs in the market. They represent, in fact, the class of sheep that London requires, and have sold well accordingly. Some of them have fetched 50*s.* each, while, as regards their price per lb., the nominal 8$\frac{1}{2}$*d.* has often proved 9*d.* when slaughtered and weighed.

Fat Lambs.—Although the season for English fat lambs is virtually over, they continue to be reported in thirteen British markets, and during October they averaged 8$\frac{1}{2}$*d.* and 7$\frac{1}{2}$*d.* per lb. for first and second quality. This was a decline of $\frac{1}{4}$*d.* per lb. on September prices, and it would have been a larger one had it not been for the Scotch markets, at several of which 9*d.* per lb. was quoted.

Fat Pigs.—There was a slight decline in fat pigs, but it did not occur till the end of the month, and the average price for bacon pigs was not much affected. First quality in about thirty British markets averaged 8*s.* per 14 lb., and second 7*s.* 4$\frac{3}{4}$*d.*, a decline of about 2*d.* per stone, as compared with September.

Carcass Beef—British.—The value of British beef in the London Central Market was well maintained till the last week, when all beef was depressed by the glut of Argentine chilled. Scotch sides then fell $\frac{1}{2}$*d.* per lb., but the averages for the month were:—Short sides, 7$\frac{1}{4}$*d.* and 7$\frac{5}{8}$*d.*; long sides, 6$\frac{3}{4}$*d.* and 7*d.*; and English second quality, 5$\frac{7}{8}$*d.* to 6$\frac{1}{8}$*d.* per lb.

Port-Killed Beef.—The average for Deptford-killed American beef was 6*d.* for first and 5$\frac{1}{2}$*d.* for second quality.

Chilled Beef.—As already intimated the market was overweighted by chilled beef. At the beginning of October best Argentine hindquarters were fetching 6*d.* per lb., but arrivals were so large that the price fell rapidly to 3$\frac{3}{4}$*d.*, and much was sold at 3*d.*, or even less. Forequarters were a drug, and forced sales resulted in little more than

nominal prices. United States chilled fetched from 6*d.* to $6\frac{3}{4}d.$, but the quantity was very small.

Frozen Beef.—With chilled beef so plentiful and cheap the trade in frozen was little more than nominal.

Carcass Mutton—Fresh-Killed.—Throughout the month all fresh-killed mutton met a very quiet and restricted trade in London, and prices were lower than in September. Scotch averaged 7*d.* and $6\frac{5}{8}d.$ for first and second quality, English $6\frac{1}{2}d.$ and $6\frac{1}{8}d.$, and Dutch $6\frac{3}{8}d.$ and $5\frac{3}{4}d.$ per lb.

Frozen Mutton.—The trade in frozen mutton continued remarkably firm, and prices were high in relation to those of fresh-killed. Best New Zealand ruled at about $4\frac{1}{2}d.$, and Argentine 4*d.* per lb.

Lamb.—There were no quotations of British lamb at the Central Market, but frozen met a good sale and advanced in price at the end of the month, when Canterbury lamb fetched from $5\frac{3}{4}d.$ to $6\frac{1}{4}d.$ per lb.

Veal.—Much of the finest Dutch veal has lately been diverted from the London market to Italy and Switzerland, and consequently this class of meat has been scarce and dear. The best qualities of English and Dutch have realised $8\frac{1}{2}d.$ per lb.

Pork.—Until the last week pork met a good trade at full prices. Small English pigs fetched 8*d.* per lb., and Dutch $7\frac{1}{2}d.$, but after the decline of $\frac{1}{2}d.$ at the end of the month the top quotation was $7\frac{1}{4}d.$ for English and $6\frac{1}{2}d.$ for Dutch.

THE PROVISION TRADE IN OCTOBER.

HEDLEY STEVENS.

Bacon.—The decline in prices reported at the end of September continued throughout the month of October, and at the close dealers were offering some of the leading brands of Continental singed sides at 18*s.* to 20*s.* per cwt. (say 2*d.* per lb.) under the prices being paid in August last, and several shillings under current rates at the same time last year. The reaction in the values of Continental sides has been brought about by the increased killings, and the reduced consumptive demand, which has not been sufficient to clear each week's arrivals. Agents have tried to force sales by reducing their prices each week. This affected all other descriptions of hog products, and especially English and Irish bacon, our curers having to accept a proportionate reduction in prices, or see the trade pass from them to those handling imported goods. Retailers having on hand purchases at the higher prices, the public has not yet fully benefited from the altered conditions. When consumers can buy at $1\frac{1}{2}d.$ to 2*d.* per lb. less, it is anticipated that there will be a considerable increase in the consumptive demand.

The trade in American bacon and hams was very small for the month, but prices do not show so great a reduction as the Continental and home productions, the drop being from 6*s.* to 8*s.* per cwt. only. The arrivals from America and Canada were again very small, and there are no prospects of any immediate increase in the quantities. Prices for American hogs again fluctuated considerably, the extremes being from \$7.90 to \$9.40, the top price at the end of the month

being $8.95. American refined lard dropped about 2*s.* per cwt. on the month.

We are still receiving fair arrivals of side meats from Russia and Siberia, and at the end of the month some really good Russian could be purchased at around 56*s.* per cwt.

English pigs can be bought still cheaper, and, with the reduced output of English bacon, curers are not such keen buyers as in the past. It is thought that we may see a reaction in the prices of English pigs before the end of the year.

Cheese.—The consumptive demand was again disappointing, and stocks on hand are still above the average. Prices are comparatively cheap; they are practically unchanged on the month, and dealers are at a loss to understand why there is not a larger consumption.

Advices from Canada report a large October make; the weather kept mild and open for dairying purposes, and in consequence the finest district makes of the month can be purchased at around 54*s.* 6*d.* per cwt. c.i.f.

At the end of the month, the estimated stock of Canadian cheese at the three principal distributing centres (London, Liverpool, and Bristol) were 426,000 cheese, against 377,000 at the same time last year, and 373,000 two years ago.

New Zealand advices confirm the previous reports that a large make is in progress. Some contracting was reported at around 55*s.* for the season's output of certain factories, but factory men are now holding for around 58*s.* c.i.f., which price the English houses refuse to pay.

In the United States of America best full-cream cheese is selling at the equivalent to 73*s.* c.i.f., and skims are realising as high as 61*s.*

With the open weather at home, our English make of cheese continued during the month, prices showing little change.

Butter.—The market lacked animation right through the month, principally on account of the mild weather, but due also to the fear among buyers that the large stored stocks, and prospective large arrivals, would result in lower prices.

Prices for Colonial are from 6*s.* to 8*s.* down on the month, which means about 8*s.* to 12*s.* under those current at the same time last year. The weather continues favourable for a large production, both in Australia and New Zealand.

Shipments from Canada were very small, and it is anticipated that the rest of this season's make will be required for home consumption. In the United States prices are slightly easier, but are still around 150*s.* per cwt. for best creameries.

Cables from Siberia at the end of the month advise that snow has fallen and the winter set in, consequently the make of butter for this season is virtually over.

Eggs.—During the whole of the month there has been a good demand for eggs, especially for strictly fresh, this description being scarce, and high in price for so early in the season. This has caused an earlier demand for pickled lots. It is anticipated that prices will be high throughout the winter.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and SCOTLAND in the Month of October, 1910.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	England. First Quality.	England. Second Quality.	Scotland. First Quality.	Scotland. Second Quality.
FAT STOCK :—	per stone.*	per stone.*	per cwt.†	per cwt.†
Cattle :—	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Polled Scots	8 6	8 0	42 2	37 11
Herefords	8 7	7 11	—	—
Shorthorns	8 5	7 7	41 2	37 2
Devons	8 7	7 10	—	—
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	*d.*	*d.*	*d.*
Veal Calves	$8\frac{1}{2}$	$7\frac{1}{2}$	$8\frac{1}{2}$	$6\frac{3}{4}$
Sheep :—				
Downs	8	7	—	—
Longwools	$7\frac{1}{4}$	$6\frac{1}{2}$	—	—
Cheviots	$8\frac{1}{4}$	$6\frac{3}{4}$	$8\frac{1}{4}$	$7\frac{1}{4}$
Blackfaced	8	7	$7\frac{1}{2}$	$6\frac{1}{2}$
Cross-breds	8	7	$8\frac{1}{4}$	$7\frac{1}{4}$
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs :—	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Bacon Pigs	8 1	7 7	7 10	6 10
Porkers	8 6	8 0	8 2	7 3
LEAN STOCK :—	per head.	per head.	per head.	per head.
Milking Cows :—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	22 14	19 3	22 1	17 18
,, —Calvers... ...	22 7	19 7	20 12	17 6
Other Breeds—In Milk ...	20 5	16 3	20 4	16 11
,, —Calvers ...	16 17	15 0	19 9	16 5
Calves for Rearing	2 7	1 15	2 8	1 12
Store Cattle :—				
Shorthorns—Yearlings ...	10 14	9 2	10 17	9 3
,, —Two-year-olds...	14 15	12 17	15 3	13 1
,, —Three-year-olds	17 9	15 13	17 4	15 0
Polled Scots—Two-year-olds	—	—	16 4	14 1
Herefords— ,,	15 10	14 2	—	—
Devons— ,,	14 12	13 1	—	—
Store Sheep :—				
Hoggs, Hoggets, Tegs, and Lambs—	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Downs or Longwools ...	33 3	28 4	—	—
Scotch Cross-breds ...	—	—	25 6	21 10
Store Pigs :—				
Under 4 months	30 9	24 2	25 8	19 5

* Estimated carcass weight.

† Live weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND and SCOTLAND in the Month of October, 1910.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Quality.	Birmingham.	Liverpool.	London.	Manchester.	Edinburgh.	Glasgow.
		per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.
BEEF:—							
English	1st	54 0	53 6	—	51 6	57 0*	66 6*
	2nd	48 6	49 6	55 6	49 0	51 0*	63 0*
Cow and Bull ...	1st	48 0	46 6	49 0	46 0	45 0	50 6
	2nd	43 6	41 0	43 6	43 0	38 6	42 0
U.S.A. and Canadian:—							
Port Killed ...	1st	—	53 6	56 6	51 6	—	53 6
	2nd	49 0	49 6	52 6	49 0	—	49 6
Argentine Frozen—							
Hind Quarters...	1st	34 0	32 6	33 0	34 0	34 6	33 6
Fore ,, ...	1st	26 6	24 6	24 6	26 0	27 0	26 0
Argentine Chilled—							
Hind Quarters...	1st	43 0	43 0	44 6	43 0	44 6	44 0
Fore ,, ...	1st	27 6	27 6	27 6	27 6	29 6	29 0
American Chilled—							
Hind Quarters—	1st	—	—	62 6	—	62 0	—
Fore ,, ...	1st	—	—	38 0	—	39 6	—
VEAL:—							
British	1st	63 0	77 6	77 0	73 6	79 6	—
	2nd	55 0	71 0	71 0	67 6	—	—
Foreign	1st	—	—	78 0	—	76 6	—
MUTTON:—							
Scotch	1st	65 6	67 6	66 0	—	60 6	66 6
	2nd	—	63 0	62 0	—	50 0	48 6
English	1st	62 0	63 0	61 0	62 6	—	—
	2nd	51 6	58 6	57 0	57 6	—	—
Argentine Frozen ...	1st	36 0	35 6	36 6	35 6	36 0	35 6
Australian ,, ...	1st	35 0	33 0	35 0	32 6	—	34 6
New Zealand ,, ...	1st	—	—	42 6	—	—	—
LAMB:—							
British	1st	—	65 6	—	63 0	—	66 0
	2nd	—	60 6	—	59 0	—	49 0
New Zealand ...	1st	53 0	51 6	54 0	51 6	—	52 0
Australian	1st	49 0	46 6	46 6	46 6	46 6	42 6
Argentine	1st	47 0	46 0	43 6	46 0	—	42 6
PORK:—							
British	1st	77 0	78 0	72 6	74 0	67 0	65 0
	2nd	70 0	67 6	66 0	69 6	60 0	62 0
Foreign	1st	—	—	68 6	—	—	—

* Scotch.

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1908, 1909 and 1910.

Weeks ended (*in* 1910)	WHEAT.			BARLEY.			OATS.		
	1908.	1909.	1910.	1908.	1909.	1910.	1908.	1909.	1910.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Jan. 1 ...	35 1	32 0	33 3	26 9	26 7	25 1	18 4	17 4	17 4
,, 8 ...	35 2	32 9	33 6	26 9	26 11	24 11	18 3	17 5	17 2
,, 15 ...	35 5	32 8	33 8	27 1	27 1	24 11	18 5	17 5	17 7
,, 22 ...	35 6	33 2	33 9	26 11	27 3	24 11	18 5	17 8	17 6
,, 29 ...	35 0	33 0	33 6	26 11	27 6	25 0	18 4	17 9	17 4
Feb. 5 ...	34 3	33 4	33 7	26 9	27 7	24 10	18 3	17 10	17 7
,, 12 ...	33 1	33 8	33 4	26 9	27 8	24 9	18 0	17 11	17 11
,, 19 ...	32 6	34 1	33 0	26 5	27 11	24 6	17 11	18 0	18 0
,, 26 ...	30 11	34 5	32 7	26 3	28 0	24 2	17 8	18 0	17 10
Mar. 5 ...	30 5	34 10	32 7	26 1	27 11	24 6	17 8	18 2	18 1
,, 12 ...	31 3	35 8	32 6	26 0	28 4	24 1	17 10	18 2	18 0
,, 19 ...	31 7	35 9	32 6	26 2	28 0	23 6	17 11	18 5	18 0
,, 26 ...	31 4	36 0	32 9	25 10	28 0	23 7	17 10	18 6	17 11
Apl. 2 ...	31 3	36 5	33 0	25 5	27 10	23 8	17 9	18 8	18 0
,, 9 ...	31 2	37 4	33 6	25 10	28 0	23 1	17 7	18 10	17 11
,, 16 ...	30 11	38 7	33 7	26 1	27 8	23 5	17 7	19 2	18 3
,, 23 ...	30 10	41 4	33 7	25 5	28 2	23 0	17 9	19 9	18 3
,, 30 ...	31 6	42 5	33 0	25 8	27 10	22 10	18 0	20 0	18 3
May 7 ...	32 4	40 9	32 6	25 5	27 7	22 7	18 4	20 3	18 2
,, 14 ...	33 1	41 6	32 1	24 9	27 3	22 0	18 7	20 6	18 1
,, 21 ...	33 8	42 8	31 10	25 9	27 0	21 8	18 10	20 11	17 8
,, 28 ...	33 5	42 6	31 3	24 6	26 3	21 4	18 8	21 0	17 10
June 4 ...	33 1	43 1	30 2	25 10	25 7	21 8	18 4	21 3	17 10
,, 11 ...	32 7	42 11	29 1	24 5	26 10	20 9	18 4	21 4	17 10
,, 18 ...	32 0	42 7	29 0	24 2	26 10	18 11	18 5	21 6	18 0
,, 25 ...	31 5	42 8	29 4	24 0	27 2	20 1	18 7	21 7	17 9
July 2 ...	30 11	42 9	29 9	23 11	27 2	19 11	18 7	21 9	17 7
,, 9 ...	30 5	43 0	30 4	24 4	26 4	19 5	18 5	21 8	17 4
,, 16 ...	30 7	43 3	31 1	23 1	26 10	21 3	18 5	21 9	17 7
,, 23 ...	31 5	44 0	31 11	26 5	27 4	19 9	18 6	22 5	17 5
,, 30 ...	31 10	43 5	33 5	24 4	24 6	20 10	18 7	22 2	18 1
Aug. 6 ...	31 6	44 9	33 9	23 1	27 4	20 5	18 9	22 11	18 3
,, 13 ...	31 6	44 9	33 5	23 10	24 9	20 4	18 1	21 8	18 0
,, 20 ...	31 2	41 6	32 11	24 5	23 11	20 11	17 10	19 8	17 11
,, 27 ...	30 10	38 5	32 7	24 5	24 7	20 10	17 1	19 4	17 2
Sept. 3 ...	30 10	37 2	32 2	25 5	26 3	22 10	17 3	19 6	17 2
,, 10 ...	31 5	34 11	31 11	25 11	26 1	23 3	17 6	18 5	17 2
,, 17 ...	31 7	33 6	30 11	26 0	26 5	24 3	17 3	17 9	16 6
,, 24 ...	31 5	32 9	30 2	26 8	26 8	24 2	17 2	17 7	16 3
Oct. 1 ...	31 7	32 2	30 1	26 11	26 9	24 4	17 2	17 2	16 4
,, 8 ...	31 5	31 8	30 1	27 5	26 9	24 7	17 0	17 0	16 3
,, 15 ...	31 2	31 4	30 2	27 6	27 0	25 1	17 0	17 0	16 2
,, 22 ...	30 11	31 8	30 4	27 5	27 7	25 3	16 11	16 11	16 1
,, 29 ...	30 8	31 10	30 4	27 5	27 9	25 4	16 11	17 0	16 2
Nov. 5 ...	30 11	32 5	30 4	27 6	27 9	25 6	17 0	17 0	16 2
,, 12 ...	31 2	32 5		27 4	27 7		17 0	17 1	
,, 19 ...	31 10	32 7		27 3	27 0		17 3	17 4	
,, 26 ...	32 3	33 0		27 2	26 8		17 5	17 3	
Dec. 3 ...	32 7	33 3		27 2	26 1		17 4	17 4	
,, 10 ...	32 8	33 3		27 0	25 7		17 4	17 3	
,, 17 ...	32 9	33 2		26 9	25 3		17 3	17 4	
,, 24 ...	32 2	33 1		26 8	25 2		17 2	17 4	

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lbs.: Barley, 50 lbs.; Oats, 39 lbs. per Imperial Bushel.

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE, BELGIUM, and GERMANY, and at PARIS, BERLIN, and BRESLAU.

—		WHEAT.		BARLEY.		OATS.	
		1909.	1910.	1909.	1910.	1909.	1910.
		s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
France:	September	39 6	46 1	25 9	25 5	20 9	21 1
	October	39 6	46 4	25 4	25 7	20 3	21 0
Paris:	September	41 5	48 10	27 7	24 8	19 8	21 8
	October	40 6	48 10	24 8	25 5	19 5	21 6
Belgium:	August	42 8	34 6	24 8	22 1	24 5	20 0
	September	35 6	33 5	24 3	21 10	20 5	19 9
Germany:	August	49 1	41 7	28 4	24 5	24 5	20 3
	September	44 1	41 0	27 3	25 4	21 6	20 2
Berlin:	August	51 10	42 6	—	—	23 9	21 3
	September	45 8	43 6	—	—	21 10	20 9
Breslau:	August	53 2	38 4	28 11* 25 9†	— 22 11†	26 5	20 3
	September	43 10	38 3	28 8* 25 1†	25 10* 22 11†	26 5	20 3

* Brewing. † Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*, the prices for the German Empire representing the average of the prices at a number of markets.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of October, 1909 and 1910.

—	WHEAT.		BARLEY.		OATS.	
	1909.	1910.	1909.	1910.	1909.	1910.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
London...	32 10	32 0	27 4	25 7	17 6	16 11
Norwich	31 11	30 4	25 1	24 6	16 8	16 1
Peterborough	30 6	29 4	28 3	26 1	16 1	15 5
Lincoln...	30 8	29 10	27 11	25 2	17 3	16 6
Doncaster	30 2	29 3	27 6	23 9	17 4	16 2
Salisbury	32 2	29 11	26 10	23 9	17 8	16 9

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND and SCOTLAND in the Month of October, 1910.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Bristol.		Liverpool.		London.		Glasgow.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12lb.
British ...	14 0	13 0	—	—	14 6	13 6	15 0	—
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery	118 0	114 6	113 0	110 0	116 0	113 0	114 0	—
,, Factory	104 0	99 6	100 0	94 6	104 0	101 0	—	—
Danish ...	—	—	117 6	115 6	118 0	116 6	117 0	—
French ...	105 6	99 6	—	—	117 6	115 6	—	—
Russian ...	109 6	100 0	107 0	103 0	106 6	104 0	105 6	102 6
Canadian ...	117 6	113 6	112 6	110 6	—	—	114 0	—
Australian ...	112 0	105 0	—	—	114 0	112 0	115 6	112 0
New Zealand	119 0	112 0	—	—	116 0	—	—	—
CHEESE :—								
British—								
Cheddar ...	74 0	59 6	72 0	68 0	74 6	70 0	59 0	55 6
			120 lb.	120 lb.	120 lb.	120 lb.		
Cheshire ...	—	—	69 6	62 6	74 0	67 6	—	—
			per cwt.	per cwt.	per cwt.	per cwt.		
Canadian ...	56 0	54 0	55 6	53 6	56 0	55 0	56 0	53 6
BACON :—								
Irish	76 6	73 0	72 6	69 0	74 6	71 6	80 6	77 0
Canadian ...	74 0	72 0	69 0	66 0	72 6	70 6	71 0	69 0
HAMS :—								
Cumberland ...	—	—	—	—	120 0	112 0	—	—
Irish	—	—	—	—	111 6	107 0	110 0	104 6
American (long cut) ...	83 0	77 0	80 6	72 0	77 6	73 6	75 6	73 6
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British ...	15 0	13 4	—	—	16 3	14 4	—	—
Irish	12 9	11 9	12 9	11 7	13 7	12 3	11 10	10 10
Danish ...	13 0	12 0	12 9	11 6	13 9	12 6	12 0	11 4
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Edward VII...	63 6	53 6	55 0	—	65 0	56 0	—	—
Langworthy ...	71 6	60 0	73 6	68 6	73 6	67 6	50 0	45 6
Up-to-Date ...	71 0	60 0	55 0	50 0	65 6	56 6	45 0	40 0
HAY :—								
Clover ...	90 0	75 0	96 0	70 0	98 6	83 6	75 0	67 0
Meadow ...	77 6	52 6	—	—	89 0	69 6	—	—

DISEASES OF ANIMALS ACTS, 1894 to 1910.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

Disease.	October.		Ten Months ended October.	
	1910.	1909.	1910.	1909.
Swine-Fever:—				
Outbreaks	165	109	1,255	1,432
Swine Slaughtered as diseased or exposed to infection ...	1,779	874	11,643	12,861
Anthrax:—				
Outbreaks	148	114	1,234	1,100
Animals attacked	167	130	1,462	1,440
Foot-and-Mouth Disease:—				
Outbreaks	—	—	2	—
Animals attacked	—	—	15	—
Glanders (including Farcy):—				
Outbreaks	30	42	322	462
Animals attacked	82	111	941	1,611
Sheep-Scab:—				
Outbreaks	17	22	367	498

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)

Disease.	October.		Ten Months ended October.	
	1910.	1909.	1910.	1909.
Swine-Fever:—				
Outbreaks	9	—	82	86
Swine Slaughtered as diseased or exposed to infection ...	156	—	1,869	1,561
Anthrax:—				
Outbreaks	2	2	7	8
Animals attacked	2	2	10	8
Glanders (including Farcy):—				
Outbreaks	—	—	1	—
Animals attacked	—	—	2	—
Sheep-Scab:—				
Outbreaks	23	21	387	330

SELECTED CONTENTS OF PERIODICALS.

Agriculture, General and Miscellaneous—

Agricultural Seeds and their Weed Impurities: a Source of Ireland's Alien Flora, *T. Johnson* and *R. Hensman*. (Sci. Proc. Roy. Dub. Soc., Vol. XII. [N.S.], No. 33, July, 1910.) [B. 18.]

Über die Messung der Lebenstätigkeit der aërobiotischen Bakterien im Boden durch die Kohlensäureproduktion, *F. H. Hesselink van Suchtelen*. (Centbl. Bakt. [etc.], Vol. 28, No. 1–3.) [B. 40–3.]

La Production des semences en Allemagne, *A. Grégoire*. (Rev. Econom. internat., Vol. III., No. 2, 1910.) [B. 18.]

Weitere Beiträge zur Frage der Stickstoffassimilation des weissen Senfes, *O. Lemmermann E. Blanck,* and *R. Staub*. (Landw. Vers. Stat., Vol. LXXIII., Heft VI., 1910.) [B. 28–5.]

Zwecke und Ziele des Pflanzenschutzdienstes und die Mitwirkung der landwirtschaftlichen Wanderlehrer an seiner Durchführung, *Dr. W. Edler*. (Arb. Deut. Landw. Gesell., Heft 167, 1910.) [E. 4.]

Field Crops—

Die Sojabohne und ihre Abfallprodukte, *F. Honcamp*. (Landw. Vers. Stat., Vol. LXXIII., 1910, Heft IV. und V.) [C. 44–3.]

The Cultivation, Preparation, and Utilisation of the Ground-Nut. (Bul. Imperial Inst., Vol. VIII., No. 2, 1910.) [C. 58–1; F. 74–5.]

Kartoffeltrocknung und ihre Bedeutung für den Bäuerlichen Betrieb, *Dobberkau*. (Arb. Deut. Landw. Gesell., Heft 167, 1910.) [C. 26–7.]

Plant Diseases—

Die Nonnen, ihr Leben und ihre Bekämpfung, *Schulz*. (Mitt. Deut. Landw. Gesell., 1910, No. 33.) [E. 40–31.]

Studien über das Verhalten des Schwarzrostes des Getreides in Russland, *A. von Jaczewski*. (Ztschr. Pflanzenkrank, Vol. XX., No. 6, 1910.) [E. 60–19.]

Grundlagen einer Monographie der Gattung Fusarium (Link), *Dr. O. Appel* and *Dr. H. W. Wollenweber*. (Arb. K. Biol. Anst. Land- u. Forst., Vol. VIII., No. 1.) [E. 60–11.]

Live Stock—

Rosskastanien als Futtermittel, *M. Kling*. (Landw. Vers. Stat., Vol. LXXIII., Heft VI., 1910.) [F. 74–3.]

Die schwedische Rinderzucht, *Dr. A. Richardsen*. (Landw. Jahrb., Band XXXIX., Heft 4/5, 1910.) [F. 26.]

Dairying—

Untersuchungen über die Reifung der Kasereimilch, *Dr. R. Burre* and *Dr. J. Kursteiner*. (Landw. Jahrb. der Schweiz, Part 6, 1910.) [G. 66–5.]

Forestry—

Forestry in the Highlands of Scotland, *W. Dallimore*. (Kew Bulletin, No. 7, 1910.) [L. 2–1.]

Die Tharandter Forstdüngungsversuche, *Dr. Vater*. (Mitt. Deut. Landw. Gesell., 3 and 10 Sept., 1910.) [L. 20–7.]

Engineering—

The Genesis and Function of the Dewpond, *H. Gibson*. (Jour. Roy. Soc. Arts, Vol. LVIII., No. 3,011, August 5th, 1910.) [M. 10.]

Economics—

Die Vererbung des ländlichen Grundbesitzes, *H. Thiel*. (Landw. Jahrb., Band XXXIX., 1910, Ergänzungsband V.) [N. 10–3.]

Der landwirtschaftliche Kredit im Deutschen Reiche, *Dr. W. von Altrock*. [N. 6–5.] Innere Kolonisation und Arbeiteranseidlung: (*a*) Allgemeines und Massnahmen der Regierung, *Dr. Stumpfe,* (*b*) Erfahrungen aus der Praxis, *Borchert*. [N. 14–7; N. 28] (Arb. Deut. Landw. Gesell., Heft 167, 1910.)

ADDITIONS TO THE LIBRARY.

[NOTE.—The receipt of *annual* publications of foreign agricultural and other departments, experiment stations and societies is not noted in the monthly list of additions to the Library. A list of these publications appeared in the *Journal* for October, November and December, 1909.]

Agriculture, General and Miscellaneous—

Spain, Consejo de Agricultura y Ganaderia de Barcelona.—Instituciones de Ensenanza y Experimentacion Agricolas necesarias en la Provincia. (87 pp. and maps.) Barcelona, 1910. [B. 44–13.]

Davey, F.—Students' Catechism on Book-Keeping. (442 pp.) London: Butterworth and Co., 1910. 3*s.* 6*d.* [B. 50.]

Smetham, A.—The Availability and Manurial Value of Purchased Fertilisers. (20 pp.) [Reprinted from the Journal of the Royal Lancashire Agricultural Society for 1910.] [B. 26.]

Die landwirtschaftlichen Kolonien in Brasilien. [Sonder Ausgabe der "Deutschen Zeitung."] (48 pp.) Sao Paulo, Brasil, 1909. [A. 84.]

Dias, Arthur.—Il Brasile Attuale. (632 pp.) Nivelle, Belgium: Stampa Lanneau and Despret, 1907. [A. 84.]

Centro Industrial do Brasil.—Le Brésil. Ses Richesses naturelles; Ses industries. Vol. I.:—Introduction—Industrie extractive. (285 pp.) Vol. III.:—Industrie manufacturière. (148 pp.) Rio de Janeiro, 1909. [A. 84.]

Campos, C.—El Brasil en 1910. (163 pp.) Rio de Janeiro, 1910. [A. 84.]

U.S. Dept. of Agriculture, Bureau of Plant Industry.—Circ. No. 67:—Seed Sterilization and its Effect upon Seed Inoculation. (11 pp.) Washington, 1910. [B. 18.]

Michigan Agricultural College Experiment Station.—Bull. No. 260:—Seeds of Michigan Weeds. (101–182 pp.) East Lansing, Michigan, 1910. [B. 20–3.]

Eastern Bengal and Assam, Agricultural Dept.—Bull. No. 18:—Notes on *Jhum* Cultivation in the Neighbourhood of Lumding. (6 pp.) Shillong, 1908. [A. 60.]

Ireland.—Report of the Recess Committee on the Establishment of a Department of Agriculture and Industries. New Edition. (387 pp.) London: Fisher Unwin, 1906. [A. 22.]

U.S. Dept. of Agriculture, Bureau of Animal Industry.—Bull. No. 39:—Index Catalogue of Medical and Veterinary Zoology. Part 31. [Authors: Thooris to Utz.] (2387–2442 pp.) Washington, 1910. [B. 7.]

Memoirs of the Geological Survey, England and Wales.—The Geology of the Country around Alresford. (102 pp.) London: E. Stanford, 1910. 2*s.* [B. 36.]

Memoirs of the Geological Survey of Ireland.—The Geological Features and Soils of the Agricultural Station of the Dept. of Agriculture at Ballyhaise, County Cavan. (50 pp. and map.) London: E. Stanford, 1910. 1*s.* 6*d.* [B. 36.]

Deutsche Landwirtschaft-Gesellschaft.—Arbeiten. Heft. 167:—Neuere Erfahrungen aus dem Gebiete des landwirtschaftlichen Betriebswesens. Neunzehn Vorträge gehalten auf dem von der D. L. G. veranstalteten VII. Lehrgange für Wanderlehre. (460 pp.) 5 M. [A. 28.] Heft 168:—Die deutsche landwirtschaftliche Pflanzenzucht. (603 pp.) 10 M. [B. 17.] Heft. 169:—Betriebsverhältnisse der deutschen Landwirtschaft. VIII. (178 pp. and tables.) 5 M. [A. 28.] Berlin: Paul Parey, 1910.

Royal Commission on the Ancient and Historical Monuments and Constructions of England.—First Interim Report:—The Ancient Monuments of the County of Hertford. [Cd. 5367.] (35 pp.) London: Wyman and Sons, 1910. 4½*d.* [A. 2.]

Royal Commission on Historical Monuments (England).—An Inventory of the Historical Monuments in Hertfordshire.* (312 pp. and map.) London: Wyman and Sons, 1910. 11*s.* 6*d.* [A. 2.]

Field Crops—

U.S. Dept. of Agriculture, Bureau of Plant Industry.—Bull. No. 182:—Ten Years' Experience with the Swedish Select Oat. (47 pp.) Washington, 1910. [C. 16.]

Philippine Islands, Dept. of the Interior, Bureau of Science.—The Sugar Industry in the Island of Negros. (145 pp. and plates.) Manila: Bureau of Printing, 1910. [C. 34–11.]

Plant Diseases—

Agricultural Research Institute, Pusa.—Bull. No. 18:—Report on the Outbreak of Blister Blight on Tea in the Darjeeling District in 1908–9. (19 pp. and plates.) Calcutta: Superintendent, Government Printing, 1910. 1*s.* 6*d.* [E. 60–15.]

U.S. Dept. of Agriculture, Bureau of Entomology.—Bull. No. 87:—Report on the Field Work against the Gipsy Moth and the Brown-Tail Moth. (81 pp.) Washington, 1910. [E. 40–9, 25, 27.]

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SOME PRACTICAL ASPECTS OF THE SCIENCE OF BREEDING.

K. J. J. MACKENZIE,
Lecturer in Agriculture, Cambridge University.

THERE are some hopes that methods purely scientific may be brought to bear on the problem of the improvement of British breeds of farm live-stock, but if the performances of the past are to be bettered, a very great deal has to be done, for since Bakewell started, Collings, Booth, Bates, and a hundred other great men have followed in his footsteps, and the improvement in our pedigree stock has been phenomenal. It will, of course, be remembered, that coincident with the work of the great breeders of the eighteenth century, the husbandry of the country changed in such a way that it is quite possible that "*feed*" as well as "*breed*" played its part in the great advance which has led to this country being called the stud-farm of the world. If this is so, however, it only adds to the difficulties of the future work, for at this moment no such improvement in *husbandry* as that which was brought about by the genius of Jethro Tull and the large-mindedness of "Turnip Townsend" can reasonably be anticipated. This being the state of the case, it seems eminently desirable that the agriculturist should thoroughly investigate every detail of the results of past work so that he may be in a position to tell the pure scientist what are and what are not the "points" of an animal on which he can profitably work. The object of this article is to bring out the necessity and to show the difficulties of such investigation even at a very early stage.

In trying to secure information dealing with the factors

which go to make up a "point," one very speedily realises that if the British breeder has used his knowledge to produce stock, admittedly unrivalled in the rest of the world, he has not been at much pains to systematise his learning so that others may avail themselves of his wisdom.

Apart from the mere surface "points," such as colour of skin, texture of hair, or the shape of the horn, it is difficult at first to specify accurately what are the actual requirements sought for. There are, however, some which may be said to be law when certain classes of stock are being considered. For instance, in all beef breeds of cattle one is informed either that the "rib should be well sprung" or that "the body should be barrel-shaped," or, again, that "the back should be wide and thick-fleshed." If any further information is given, one may learn that the animal is "good at the roastings." This latter definition is, as far as our present information goes, the most truthful, if somewhat crude, definition of the point aimed at, for to get a good butcher's beast, the breeder aims at one which carries a large proportion of prime "joints" or "cuts," and the point mentioned is valued because it denotes the presence of an abundance as well as a superior class of one particular prime joint. This joint is known in the trade as the "fore-rib." It is essentially a roasting cut. It consists of the dorsal half of the four posterior ribs, the dorsal half of the three first false ribs, together with the meat or flesh carried by these seven ribs. While it is quite possible to say that a live animal having the point under consideration will yield a carcass carrying a good "fore-rib," it is not so simple to determine how the desired effect is brought about. Is the rib well sprung, *i.e.*, has it such a shape of itself that it makes the animal like a barrel; or is it a question of the frame work, formed by the horizontal line of rib and the vertical spine, carrying a thick layer of muscle or flesh; or are both shape of bone and muscle-development of as much importance as the factor known to the butcher as "marbling"? It would seem quite possible that the infiltration of fat into the tissue of the muscle, giving what the butcher calls a marbled flesh, may be the deciding factor. Or, again, this "point" may be somewhat influenced by the manner in which the rib is braced at its articulation to the spinal column.

We have these four possible factors influencing this point:—

1. Shape of rib bone. 2. Attachment of rib to spinal column. 3. Muscular development. 4. "Marbling" or infiltration of fat into the muscle tissue.

A concrete example of a butcher's point about which it is desirable to learn more may be given. Professor Wood's work at Cambridge on the inheritance of face-colour in sheep has led to a demand from an association of sheep breeders in Australia. These Colonial flock-masters want a sheep bred which combines the fleece of the Merino (which breed is a poor butcher's sheep) with the good mutton carcass of the Shropshire-down. A most important "point" in the butcher's sheep is the leg of mutton. In order to get exact data whereby this point may be followed from generation to generation, Dr. Marshall, of the Cambridge Department of Agriculture, and the writer of this article, find that the following questions have to be answered:—Does the leg of mutton carried by the Merino carcass fail (i.) because of the position of the sacrum with regard to the haunch bones, or (ii.) because the haunch bones are too flat, or, in technical words, because the pelvic line from ilium to ischium is not sufficiently concave to allow of proper muscular development, or (iii.) is the length of haunch bone from ilium (hip) to ischium (pin-bone) deficient, or (iv.) is the muscle, or flesh, covering the pelvic arch and the bones of the leg deficient, or (v.) is it because of the absence of fat from this particular part of the muscular system, or, in other words, want of marbling?—It would seem, as judged by inspection, that fat, in the case of the leg of mutton, plays the more important part as a covering, and that the marbling is a secondary consideration. It will easily be seen how difficult it is to ascertain exact data on all these questions. The ewes and rams mated together had to be measured in respect to all the above questions, and the positions of the sheep had to be exactly the same, for experience showed that a slight movement altered the alignment. A scale had to be arranged, as far as possible, to determine the state of fatness of each animal; for obviously it is necessary to know if the measuring standard is covering bone and muscle only, or bone, muscle, and a quantity of fat. Having got the measurements in 1909

the investigators must wait till 1911 before the first-cross offspring will be of the same age and consequently at the same stage of growth as the parents were at the time of measurement. Not only have measurements of sheep with sheep to be compared, but different measurements on the same animal must be examined to see if there is any correlation of "points" to be found.

A belief undoubtedly exists among practical farmers that certain "points" and characters are correlated. For instance, among horses, the Shire breeders' belief is that abundance of a particular type of hair denotes constitutional vigour. Again, abundance of straight, silky hair is said to denote among swine the existence of a large proportion of lean flesh. Face and leg colour in sheep are held to be indications of a special type of mutton, which is further alleged to be of a "short-grain" and distinct flavour, which is particularly palatable to the epicure. A yellow colour of skin and horn in cattle is held to denote rich milk, and width between the eyes is very universally believed to denote strength of constitution. A short, wide head, with a deep, well sprung, clean jaw, free from "throatiness," is very firmly believed by very many graziers to denote quick-feeding capacity in bullocks.

Innumerable instances of belief in some particular "point" denoting some particular character will be known to all who have made an extended study of animal husbandry, and it would be wearisome to refer to more than the instances already given. Very few who have given much attention to the subject would be prepared to say that there is no truth in any of these alleged correlations. On the other hand, there is little more than the personal *opinion,* and that by no manner of means universal, of the intelligent breeder, stud-groom, or cowman to demonstrate the truth of the existence of (to borrow a Mendelian term) such "coupling" in live stock. It seems self-evident that it is necessary to ascertain how much truth there is in any or all of them, for they are factors which might be of the greatest possible value to the man of science.

One department of this subject to which the writer has given considerable attention is represented by the "points" of a deep milking cow. It has been held for a long time that a milch cow should be fine at the chine, well-sprung in the rib,

and wide at the hip or hook. This idea is not of recent origin, for it is referred to by many writers at the beginning and in the middle of the last century. It will be understood that these "points" may be summed up by saying that the back of a good dairy cow should be wedge-shaped when viewed from above. An American writer on animal husbandry, Mr. William Warfield* avers this to be a fact of "common observation," so that the belief is evidently widespread. Personal observations have led to the belief that while it is on the whole true, there are very many exceptions. It would seem that while most cows which milk well are fine at the chine (or to be exact, are narrow where the shoulder blades lie alongside of the spine) when they are in full milk, many will be broad there when they have done milking, and put on flesh. It would seem, however, from handling good milkers, that such cows are wedge-shaped at the chine, *i.e.*, that all deep milking cows are so shaped that the *shoulders are very much closer* together in front than at the back. Put in another way, it seems, judging by handling only, that in the case of cattle which milk well, be they good or bad for the butcher, it will be found that though the shoulder blades "over the heart" are "open" or wide apart, the lines of the scapulæ (or shoulder-blades) continued towards the head of the animal come to a sharp point.

It does not seem easy to form any definite opinion about the wedge-shape of the rest of the body. Some cows seem to milk very well, though the whole length of the back from the chine to loin looks very narrow indeed, there being no sign of a wedge-shape. This wedge-shape would be given by a well-sprung rib, and many of the best milkers seem to be flat-sided.

By the kindness of their owner it has been possible to measure some of the cattle belonging to Lord Rayleigh. In these famous herds are to be found a great number of cows kept for milk production under exceptionally skilful management, and milk records have been kept for a great many years, and these conditions are essential to any real test of the sort.

With the assistance of Mr. Gerald Strutt and the manager (Mr. H. Jones), Mr. R. Beverley, of the Cambridge Agri-

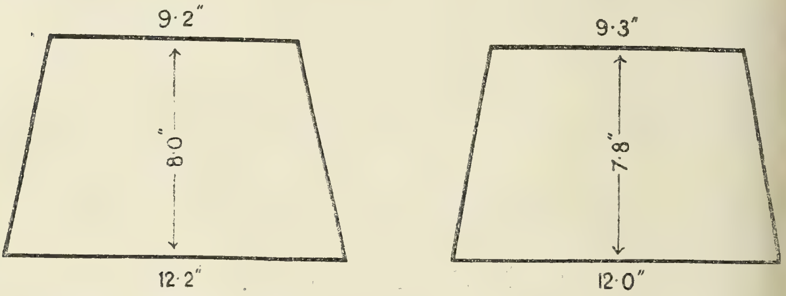
* "Cattle-Breeding," by William Warfield, p. 76, J. H. Saunders Publishing Company, Chicago, 1902.

cultural Department, and the writer have taken the following measurements. The method of proceeding was to measure cows that were selected owing to their record of milk production. The animals were divided into two groups according to their milk records. The 40 cows in Group A averaged 814 gallons per annum, the 40 cows in Group B averaged 556 gallons per annum; the yields of milk given after first and second calf being included in all cases.

There are several ways in which we have sought to test the wedge-shape of the cow by measurement—(i.) as regards chine only, difference of width in front and at the back of that point. The results are (see Diagram I.) as follows:—

Average of 40 cows in *Group A.*	Average of 40 cows in *Group B.*
Slope 1 in 5·3	Slope 1 in 5·8

The difference might well be explained by experimental error.



Group A.—Slope 1 in 5·3. Group B.—Slope 1 in 5·8.

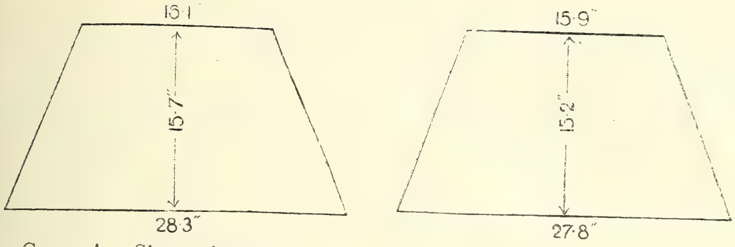
Diagram I.—Cows Wedge-shaped at Chine.

(ii.) The next measurement shows the difference between the width of ribs at the narrow point immediately behind the shoulder, and the width of ribs at the widest point, which approximately we have always found to be on the line of the third *false* rib, or twelfth rib counting from the neck. (See Diagram II.) The following results were obtained:—

Average of 40 cows in *Group A.*	Average of 40 cows in *Group B.*
Slope 1 in 2·57	Slope 1 in 2·55

Here again no marked distinction has been found, though Group B shows the greater wedge.

(iii.) In the third case we have tried to judge the spring of rib by measurement. Diagram III. is given to explain how this measurement was taken. We found the ratio of arc to



Group A.—Slope 1 in 2·57. Group B.—Slope 1 in 2·55.

DIAGRAM II.—COWS WEDGE-SHAPED AT RIBS.

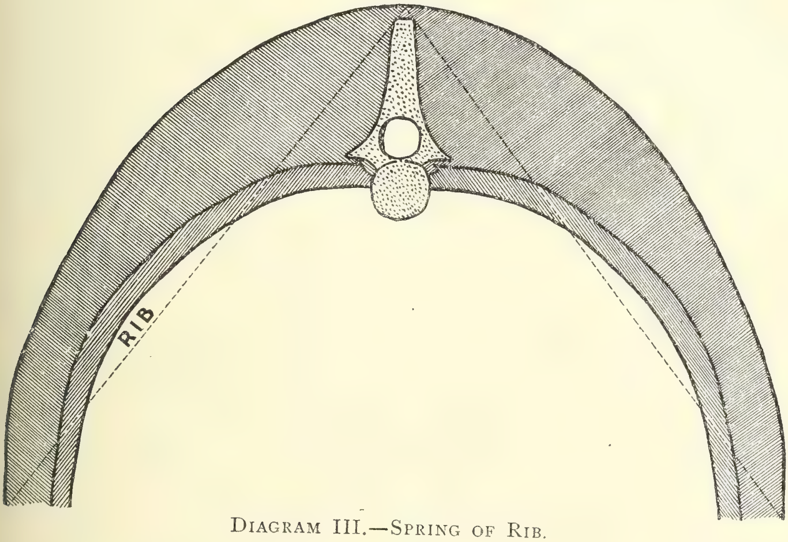
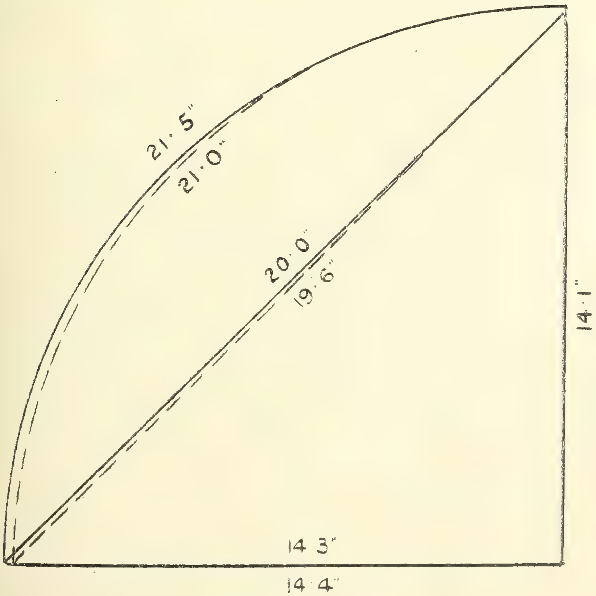


DIAGRAM III.—SPRING OF RIB.



Group A ————
,, B - - - - - -

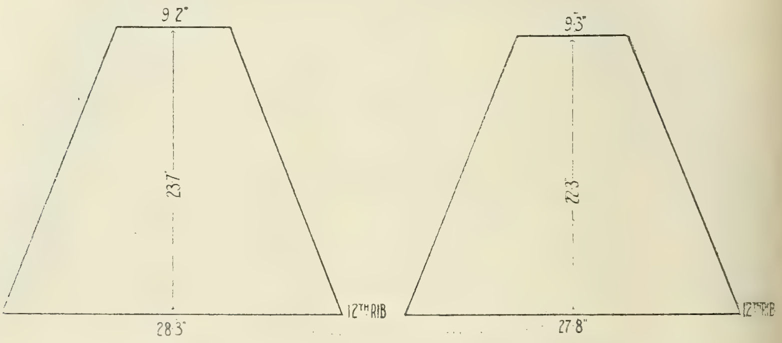
DIAGRAM IV.—PLAN OF SPRING OF RIB.

segment to be as follows, *i.e., the same to one part in* 1,000.

Average of 40 cows in *Group A.*	Average of 40 cows in *Group B.*
1·075	1·074

Diagram IV. shows graphically how very little difference there is between the two groups of animals.

(iv.) The next diagram (V.), again dealing with the wedge-shape, contrasts the width of the cow at the front of the chine and at the widest part of the ribs. Considering the anatomical structure, these measurements must be looked upon with a critical mind, for in the case of the rib's measurement we have only rib, flesh, and skin of the animals between the



Group A.—Slope 1 in 2·48. Group B.—Slope 1 in 2·41.

DIAGRAM V.—WIDTH OF COW AT FRONT OF CHINE AND AT WIDEST PART OF RIB.

points, but at the chine we have rib, skin, flesh, and *shoulder blade bone*. They are interesting however, for when judging a cow by inspection the eye would naturally follow the lines formed by joining up such points. It will be seen by Diagram V. how very similar the wedges are found to be.

It has been further held that another "point" in a milch-cow is that she should be deep in the body. The following figures give the average depth and height of the cows (in inches) in Groups A and B and the ratios between these measurements.

Group A. Average Depth.	*Group A.* Average Height.	*Group B.* Average Depth.	*Group B.* Average Height.
28·5	51·6	28·2	51·4

Group A. Percentage of Depth to Height.	*Group B.* Percentage of Depth to Height.
55·2	54·8

Length of quarter, *i.e.*, from hook to pin-bone, is also claimed as a good "point," and the following measurements

(in inches) illustrate how much truth we found in this claim when the cows were measured.

Average of 40 cows in *Group A.* Total Length of Body.	Length of Quarter.	Average of 40 cows in *Group B.* Total Length of Body.	Length of Quarter.
59·2	19·3	58·4	19·2
Percentage of Length of Quarter to Total Length.		Percentage of Length of Quarter to Total Length.	
32·6		32·9	

The quarter measurement is one of three taken on the pelvis, all of which are held to be good "points," viz.:—

(1) Length of quarter, *i.e.*, from hook (the ilium) to pin-bone (the ischium); (2) width from hook, or hip (the ilium) to hook; (3) width from pin-bone (the ischium) to pin-bone.

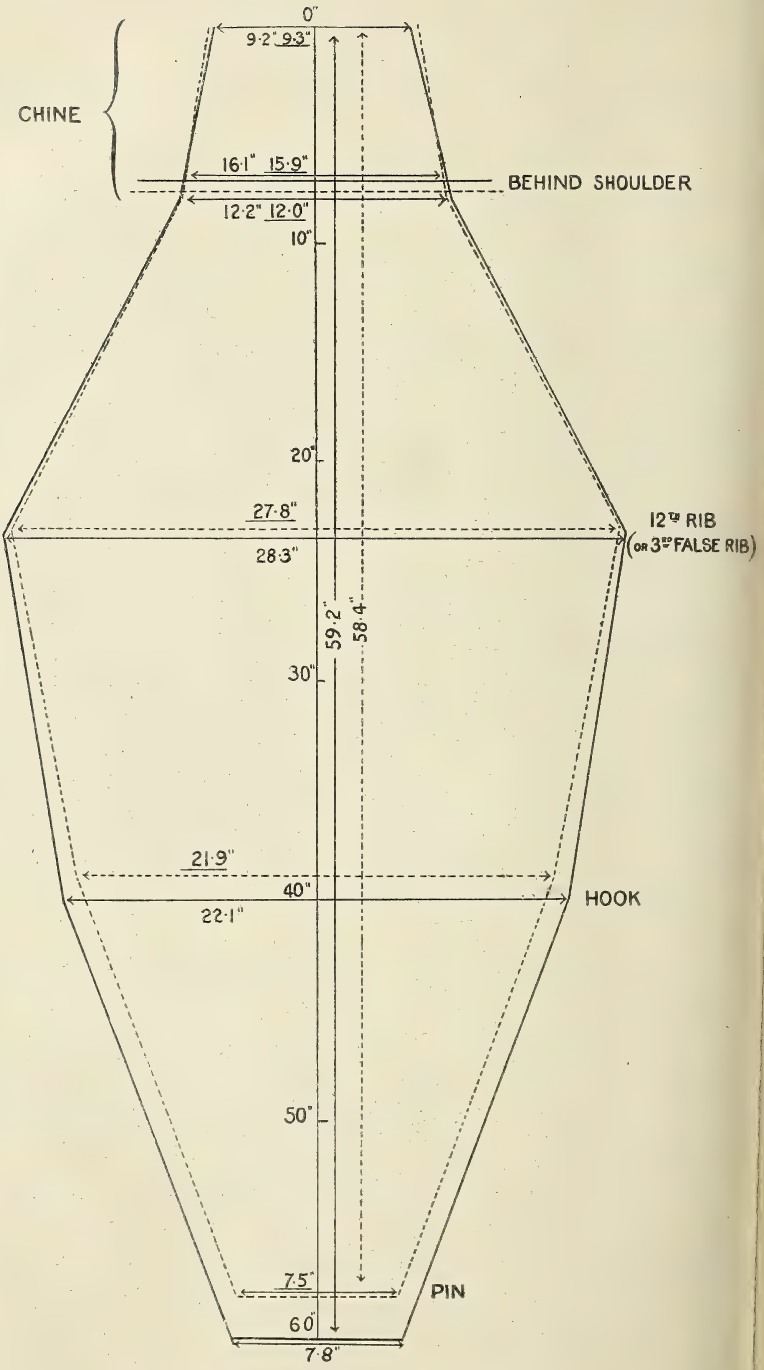
It would seem eminently reasonable to consider these three points together, for they are measurements of the horizontal frame on which the udder is hung. Obviously a large gland will hang more easily on a big pelvic frame than on a small one. And, all other things such as quality being equal, a large udder will yield more milk than a small one. There is also the consideration of the large pelvis making parturition easier. The respective sizes and shapes of pelvic frame found in the two groups of cattle have been compared, and it is found that the measurements come out as follows, if the size of the pelvic frame be compared with the size of the whole of the body.

Average of 40 cows in *Group A.* % of Pelvic Frame to Body Plan.	Average of 40 cows in *Group B.* % of Pelvic Frame to Body Plan.
26·24	26·36

The final diagram is that of the body plan obtained from the measurements taken. (See Diagram VI.) From this it will be seen how very similar are the two sets of cows when compared in this way.

The figures obtained by Mr. Beverley and the writer have been worked out, as shown by the above diagrams, by Professor T. B. Wood, of the Cambridge School of Agriculture. Professor Wood is going to subject them further to thorough mathematical tests to see if any correlation can be found in regard to any measurement and any "point."

Attention may be drawn to the great difficulty found in taking the measurements, and though every care was taken, more especially in practising before beginning these actual



Group A ————
Group B - - - - - -

(Measurements relating to B Cows are underlined.)

Diagram VI.—Body Plan Obtained from the Measurements Taken.

operations among the herds in question, we suggest that a large amount of "experimental error" ought to be allowed for; experience, no doubt, will lead to better methods and the creation of more perfect instruments. Even then, however, it would seem difficult, without a post-mortem examination, to ascertain how much of the difference obtained by measurement is due to the frame and how much to the condition of the animal under observation.

There are other considerations which we find of value when dealing with the measurements taken to enable the above diagrams to be made. As has been said, all the cows measured are in Lord Rayleigh's herds. They have been bred, or in a few cases bought, fed, and managed, under the most skilful supervision, with the one idea of milk-production. It is quite possible that many of the animals which are in Class B are there from some accidental cause, and that such cows, had circumstances been different, might have been promoted into Class A. We must also emphasise the fact that the cows in Class B, though the very-worst in these herds, can only be called bad milkers when contrasted with those in Class A. Were it possible to get the records of some of our beef-breeds it would probably be found that, by comparison, the cows in Class B would be quite good milch cattle.

There is another matter which seems worthy of consideration, and that is, that though a cow may milk well when all or many of the milk-indicating points are absent, yet it is possible that she may be a less useful animal because of their absence. This may be illustrated by only one example—for this subject opens up a very vast field for speculation—a flat-sided cow which milks well may, owing to the restriction of space in the body cavity, be unable to carry a good calf, and consequently fail as a breeder.

It is not in any way intended to suggest that the judge in the show ring or the buyer of pedigree stock at the auction sale will be benefited by obtaining such measurements. It is rather, on the contrary, suggested that a very thorough and complete investigation should be made of the methods employed by judges at present, so that their practice may be more completely understood. It is, however, the object of this article to suggest how much the agriculturist may have to do

before he is in a position to supply the scientist with that very accurate information which is essential to systematic work. The scientist, we know, is willing and anxious to help, and it is to be hoped that he and the agriculturist together may in the future even improve British pedigree stock, which to-day stands, as a class, the best that the breeders of the world can produce.

THE USE OF STARTERS IN DAIRYING.

By JOHN PORTER, B.Sc.,

Organiser of Agricultural Education for Herefordshire.

It is only a few years since modern methods were introduced into butter and cheese-making. Previous to that the resultant product was not all that could be desired. Cheese and butter merchants complained that there was a great lack of uniformity in the quality, with the result that they had difficulty in giving satisfaction to their customers. Now, however, the situation is changed. By the use of the "starter" the butter-maker and cheese-maker may control the ripening of the cream or the development of acidity in the cheese-making process to such an extent that the production of a uniform article can be accomplished. In fact, success in butter and cheese-making is only possible where the ripening process or development of acidity is properly controlled.

The Theory of Ripening.—Everyone has observed that milk or cream exposed to the air soon becomes sour and curdles. This development of acidity is brought about by the activity of the lactic acid bacteria, which find their way into the milk, live in it, feed on the milk sugar or lactose, and change it into lactic acid. The lactic acid produced precipitates the casein, causing the milk to curdle or thicken. This development of lactic acid in milk or cream is called the "ripening process." These bacteria are susceptible to heat and cold. At very high temperatures they are killed, while towards freezing point they cease to be active. Between these two extremes there is an optimum temperature, somewhere about 80° or 90° Fahr., at which they develop and multiply very rapidly. To hasten the ripening process, one must raise the temperature of the milk or cream as near the optimum as possible, while to retard it, the milk or cream

should be cooled down to 50° Fahr. or even lower. Close attention to temperature during the ripening process is imperative, if a superior article is to be obtained.

Starters.—A starter is really a culture of bacteria which change the sugar of milk (lactose) into lactic acid. These bacteria occur in abundance in sour milk, butter-milk, sour whey, cheese, etc., and the first three of these may be used for this purpose, provided they have a clean sharp flavour and are not tainted in any way with other injurious bacteria. Commercial starters can be obtained in the form of a liquid or powder, but the liquid starter is the one chiefly used in this country.

These commercial starters are pure cultures of lactic acid bacteria, and can be made in the following way:—Take three test tubes containing nutrient gelatine, and maintain at a temperature of 100° Fahr. to keep the gelatine liquid. Make a loop on the end of a platinum wire, sterilise it, and place a loopful of sour milk, which has a clean, sharp, acid flavour, in No. 1 tube and stir after adding. Transfer a loopful of inoculated gelatine from No. 1 to No. 2, stir again and do likewise from No. 2 to No. 3. The contents of Nos. 2 and 3 are poured into sterilised plates with covers on, and spread evenly over the bottom. This is called "laying the plates" or practically "seeding" them. Each, or at least several, of the species of bacteria flourish on the nutrient gelatine, and by multiplication form colonies after their own particular kind, provided they are incubated at a suitable temperature (70° Fahr.). After examining these colonies under a microscope to see if the desired form of bacterium is present, one of these colonies is selected and cultivated further on gelatine, agar-agar, and in sterile milk, to make sure that none other than the lactic acid forming bacteria are present. The required organism having been isolated, it is propagated from day to day in a suitable medium like separated milk, which has previously been pasteurised, and in this way a pure culture is obtained. This, so to speak, concentrated culture of the lactic acid bacteria is what we get when a "starter" is bought.

It is generally found best to prepare sub-cultures from commercial starters to get rid of any flavour of the medium on which the bacteria have been cultivated, and this is best done

by taking half a gallon of separated milk in a clean enamel pail, heating it to 170° Fahr., and then cooling to 84° Fahr. Into this, after shaking the bottle containing the pure culture, pour the contents of the bottle, stir and then cover with a muslin cloth. Set in a room at a temperature not below 65° Fahr. for twenty-four hours. The milk should then be thick and sour. Make a second sub-culture from this by taking some more separated milk which has been pasteurised, and, after skimming off the top layer, take, say, a pint from the centre of the culture in the first pail and strain into it. Set as before. A third culture should sometimes be made. This can safely be used for hastening the ripening process. Each day about a pint should be reserved for inoculating more pasteurised separated milk for the following day's starter. A good starter will contain ·75 to ·85 per cent. of lactic acid, and in order to get this one needs to attend to the time of setting, the temperature of the milk to be inoculated, the amount of starter used, and the temperature of the dairy. Where a night temperature of 70° Fahr. can be looked for, good results can be obtained by adding ½ to ¾ pint of the previous culture to each gallon of scalded milk and setting it at 4 or 5 p.m. With the dairy at a lower temperature, it must be set earlier; about midday answers well in some dairies.

Home-made Starters.—These can be prepared by taking two enamelled pails and pouring into one some newly separated or skimmed milk which has been pasteurised and cooled. Set in a warm place for 24 hours, when the milk will be sour and thick. Skim off the surface and break up the centre of this soured milk, then take about half a pint and add to a similar quantity of milk in the second pail, which has also been previously pasteurised and cooled to about 65° Fahr. Make a sub-culture from this, as mentioned above, when the third one should be fairly pure culture. If the surface or any part becomes discoloured, this part should be rejected and only the pure white portion used. When the starter becomes weak and does not sour the milk sufficiently, either more starter should be used or a fresh pure starter made. It is advisable to prepare as much starter as will equal about 1 per cent. of the milk to be inoculated. After setting a

culture for the next day, it should be occasionally stirred during the evening, but not on the following morning. The preparation of home-made starters exerts a purifying influence on the bacteria content of the starter, and results in the elimination of bacteria which are unnecessary, if not harmful, to the production of a first-class article.

The characteristics of the bacteria in a starter should resemble those found in ripened cream or in good cheeses, and they should by no means produce gas. The culture should have a clean, sharp, acid flavour, and when added to milk or cream be capable of eclipsing to a large extent the development of obnoxious bacteria. The organisms should neither liquefy gelatine nor produce spores, and when examined under the microscope should occur in pairs or figure eight, as short bacteria with rounded ends.

Butter-making.—The proper ripening or souring of milk is of great importance in the manufacture of the best quality of butter. Fresh cream already contains about ·10 to ·12 per cent. of lactic acid, but this acidity has to be increased up to about ·6 per cent. before cream is sufficiently ripe for churning into butter. In some dairies, however, ·45 per cent. of lactic acid is thought sufficient. The amount of acid necessary in ripened cream is by no means constant, as this varies with the time of year, breed of cow, etc. Generally speaking, the acidity in cream should be developed to a greater extent in spring or autumn than in summer. Milk or cream from Ayrshire cows needs more acidity than that from Jerseys; this is due to the ripened cream being more tenacious in the case of the Ayrshire product, thus hindering the releasing and running together of the fat globules, which are entangled in it during churning.

Little doubt now exists with regard to the advisability of ripening cream, as it gives more flavour to the butter, makes it easier to churn, and also gives an increased yield of butter, often as much as 8 per cent. more.

The natural ripening of cream is not altogether satisfactory, because in this case the cream is left exposed to the atmosphere of the dairy, and the length of time for ripening varies with the temperature of the dairy, as well as with the addition of fresh cream from day to day. The higher the

temperature the quicker will the ripening be, and the lower the temperature the slower will the ripening process take place. The addition of fresh cream hinders ripening, and when this is done care should be taken to stir the cream after each lot is added, or the ripening is not uniform; there is also loss of fat in the butter-milk after churning, while the butter is liable to be inferior in quality. Fresh cream should not be added to ripening cream for at least 12 to 24 hours before churning. If milk has a taint and the cream from it is naturally ripened the taint remains and the butter becomes affected. Natural ripening, therefore, is not very satisfactory, as the time of churning is difficult to predict, and the quality of ripened cream is liable to great variation.

The secret of securing uniformity in the quality of butter lies in the judicious use of starter. First of all, the cream, if at all tainted, must be scalded and cooled down to about 60° Fahr., so as to drive off the taint; then add ½ pint of good starter, through a strainer, to each gallon of cream. The cream, if kept at approximately 60° Fahr., will be ripe in about 24 hours. If the cream ripens too slowly, more starter should be added and *vice versâ*. Churning should be delayed as little as possible after the cream is ripe; otherwise difficulties might arise, as over-ripened cream causes the curd to harden, is more difficult to churn, renders the butter soft and greasy, spoils the flavour and causes loss in butter-fat. The butter may also contain white lumps of curd, which cause it to become cheesy in a few days. If it is not convenient to churn when the cream is ripe, the best way is to cool it down as low as possible. A little fresh cream stirred in, or the addition of a little salt, would have a similar effect. A good butter-maker can control the ripening process as desired.

Cheese-making.—In the making of Cheddar cheese, it is common to use mixed morning and evening milk, with the result that the evening milk has to be kept over-night in some suitable receptacle before the morning milk can be added, and during this time develops a certain amount of acidity, depending largely on the temperature at which it is kept over-night. The required amount of acidity may be developed largely in the evening or in the mixed milk after

the morning milk has been added, which gives us two distinct systems.

In the former system, where the temperature of the evening milk is largely determined by diurnal variations, and as the acidity develops quickly or slowly accordingly as the milk is kept warmer or colder, there is no uniformity in the amount of acidity developed over-night. It may be too much or too little. This is sometimes responsible for discoloration in cheese. Where the milk is tainted or becomes so in the dairy over-night, the taint becomes intensified. The development of acidity in the evening milk is apt to cause discoloration of, and lack of uniformity in, the cheese.

With the latter system the acidity is not developed till morning. The evening milk is cooled down as low as is practicable, so that a minimum amount of acidity develops over-night. After mixing the morning milk the temperature should be raised to 84° Fahr. and the milk tested by the rennet test to ascertain exactly the amount of acidity in it. The correct time is when the milk takes 19 to 21 seconds to curdle, and this is the time renneting should take place. If the cheese can be finished in five or six hours and is satisfactory in flavour, no starter is required; but if not it is well worth while to use a starter. Working with a good starter containing ·6 to 1 per cent. of lactic acid, the quantity to add varies inversely to the acidity of the milk. The rate at which cheese-making has proceeded on previous days should be kept in mind. One expects to have the cheese made in five or six hours and, if it requires longer, more starter should be added on future occasions to hasten the process. Supposing the milk took thirty seconds with the rennet test, one would need to add starter equal to 3 per cent. of the milk being made into cheese. One rather interesting point is, that when starter has been added to the milk, the rennet test should not be made for about twenty minutes, otherwise the milk will work faster than the test indicates.

This system is much to be preferred, as it overcomes the difficulties which arise in the other. The evening milk being cooled down and prevented from developing acidity as much as possible, never contains too much acidity in the morning, and the amount present is fairly uniform too, with the result

that the process goes on at pretty much the same rate each day. On this account the resultant product is much more uniform in quality. If the evening milk is tainted, the taint is kept in check, with the result that the starter when added has a fairly clear field and develops so rapidly that the taint is largely overcome. With the use of starter much time is saved by hastening the rate at which the process of cheese-making goes on, and, above all, uniformity in the quality of the cheese is rendered possible.

THE RAILWAY TRANSPORT OF AGRICULTURAL PRODUCE.

GEO. B. LISSENDEN.

The object of this article is to call attention to certain matters which should be kept in view by farmers, market gardeners, and agriculturists generally, who desire to forward and receive goods at a minimum of expense.

It is frequently alleged that railway rates for the conveyance of agricultural produce are too high; but the merits or demerits of this complaint will not be gone into here, the present purpose being merely to bring to the notice of those interested the ways and means which exist to-day for reducing the expenses connected with the transportation of their goods.

Packing and Dispatch.—It cannot be too strongly impressed upon consignors of such goods as agricultural produce, that careful attention must be paid to the matter of packing. If through being insecurely fastened a package comes open during transit and loss arises in consequence, the railway company may contend that the loss was the direct result of defective packing, and that they, therefore, are not liable, and in this case the claimant may experience some difficulty in obtaining compensation. If boxes are used they should be secured by nails, and not by rope or cord. The reason for this method is that it is difficult to remove the contents of boxes which have been nailed up without leaving evidence of pilferage, and where such evidence exists railway companies are generally prepared to pay compensation, even though the goods were carried at owner's risk.

Much delay and loss is caused by failure to address consignments sufficiently and to send them to the station in time

to be loaded before the train is due to start. Consignors should remember that an address which is legible to themselves is not always legible to other people, and that the late arrival of their goods at the station may cause loss not only to themselves, but also to their neighbours, whose consignments are carried by the same train. The following notice, which is typical of the notices issued by railway companies on the points above referred to, shows their attitude in these matters:—

"The company earnestly wish to co-operate with agriculturists in getting produce to its destination economically, expeditiously, and in good marketable condition; and it will be apparent that senders can materially assist in this direction by addressing their consignments fully and legibly, and by bringing them to the forwarding stations in such good time as to enable them to be carefully loaded and dispatched by early trains. It is also suggested that agriculturists should render due attention to details of packing, in order to meet the varying requirements of buyers in different districts, and so that articles placed upon the markets may be in the best possible condition for sale."

Several of the railway companies have now on sale at all of their stations from which produce is forwarded, light and inexpensive boxes. For example, the Great Western Railway Company and the South Eastern and Chatham Railway Company supply boxes as under:—

G.W.R.

	Ins. (Length)		Ins. (Breadth)		Ins. (Depth)	Price Each
No. 1 ...	$10\frac{3}{4}$	×	$7\frac{1}{2}$	×	3	2d.
No. 2 ...	13	×	9	×	$4\frac{1}{2}$	$2\frac{1}{2}$d.
No. 3 ...	$15\frac{3}{4}$	×	$10\frac{3}{4}$	×	5	3d.
No. 4 ...	$16\frac{3}{4}$	×	$11\frac{1}{4}$	×	$5\frac{1}{2}$	$3\frac{1}{2}$d.
No. 5 ...	$18\frac{1}{2}$	×	13	×	6	$4\frac{1}{2}$d.
No. 6 ...	$21\frac{3}{4}$	×	15	×	7	$5\frac{1}{2}$d.

S.E.C.R.

	Ins. (Length)		Ins. (Breadth)		Ins. (Depth)	Price Each
No. 1 ...	$10\frac{3}{4}$	×	$7\frac{1}{2}$	×	3	$2\frac{1}{2}$d.
No. 2 ...	13	×	9	×	$4\frac{1}{2}$	3d.
No. 3 ...	$15\frac{1}{4}$	×	$10\frac{3}{4}$	×	5	$3\frac{1}{2}$d.
No. 4 ...	$16\frac{3}{4}$	×	$11\frac{1}{2}$	×	$5\frac{1}{2}$	4d.
No. 5 ...	$18\frac{1}{2}$	×	13	×	6	5d.
No. 6 ...	$21\frac{3}{4}$	×	14	×	7	6d.

The inconvenience of returning empty packages may be avoided by the use of these boxes.

Small Consignments by Passenger Train.—For the conveyance of small consignments of farm and dairy produce by passenger train the majority of the companies—at any rate, all those who carry this traffic—have special low rates in operation. For example, the Great Western Railway Company's scale for such goods is as given in the table on the next page.

The other companies' rates for these goods differ very little, if at all, from these. These scales enable the consignor to tell in advance what will be the charge of a parcel of a given weight travelling to a particular place, and are also useful for

the purpose of checking the railway company's carriage account, but the signing of an owner's risk consignment note is an indispensable condition attached to the carriage of goods at these rates.

FARM AND DAIRY PRODUCE.

Scale of rates for the conveyance of small lots of the following goods by passenger train :—Butter, cheese, cream, fish, eggs, honey, game (dead), poultry (dead), rabbits (dead), meat, vegetables and fruit (hot-house and not hot-house), flowers, plants, bulbs, seeds, ice, mushrooms.

Distance.	2 lb.	3 lb.	7 lb.	9 lb.	10 lb.	12 lb.	14 lb.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Up to 30 Miles ...	0 4	0 5	0 6	0 6	0 6	0 6	0 6
,, ,, 50 ,, ...	0 4	0 5	0 6	0 6	0 6	0 6	0 6
,, ,, 100 ,, ...	0 4	0 5	0 6	0 6	0 6	0 6	0 7
,, ,, 200 ,, ...	0 4	0 5	0 6	0 7	0 8	0 9	0 10
Above 200 ,, ...	0 4	0 5	0 6	0 8	0 9	0 10	0 11
Distance.	**16 lb.**	**17 lb.**	**19 lb.**	**20 lb.**	**21 lb.**	**24 lb.**	**Above 24 lb.**
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	d.
Up to 30 Miles ...	0 6	0 6	0 6	0 6	0 6	0 6	$\frac{1}{8}$ per lb.
,, ,, 50 ,, ...	0 6	0 6	0 6	0 6	0 6	0 6	$\frac{1}{4}$,,
,, ,, 100 ,, ...	0 7	0 8	0 8	0 8	0 9	0 9	$\frac{3}{8}$,,
,, ,, 200 ,, ...	0 10	0 11	0 11	0 11	1 0	1 0	$\frac{1}{2}$,,
Above 200 ,, ...	1 0	1 0	1 1	1 2	1 2	1 3	$\frac{5}{8}$,,

Including Free Delivery (but not collection) within the usual limits at those places where the Company performs such service.

Owner's Risk Conditions.—Considerable economy may be effected by taking advantage of owner's risk rates, as the difference between the owner's risk rate and the ordinary risk rate is generally much greater than the sum which would be sufficient to cover the risk of loss in transit, but it is desirable that consignors should understand the nature of the contract which they make in order to effect this economy.

The "owner's risk" consignment note contains a condition to the following effect :—

"Receive and forward the under-mentioned merchandise, to be carried at the reduced rate, below the company's ordinary rate, in consideration whereof I agree to relieve the (contracting) railway company, and all other companies or persons over whose lines the merchandise may pass, or in whose possession the same may be during any portion of the transit, from all liability for loss, damage, misdelivery, delay or detention, except upon proof that such loss, damage, misdelivery, delay, or detention arose from wilful misconduct on the part of the company's servants."

The term "wilful misconduct" has been defined as follows in the case of Forder *v.* Great Western Railway Company (1905), 2 K.B., 532:—

"Wilful misconduct in such a special condition means misconduct to which the will is party as contra-distinguished from accident, and is far beyond any negligence, even gross or culpable negligence, and involves that a person wilfully misconducts himself who knows and appreciates that it is wrong conduct on his part in the existing circumstances to do, or to fail or omit to do (as the case may be) a particular thing, and yet intentionally does, or fails or omits to do, it, or persists in the act, failure, or omission regardless of consequences . . . or acts with reckless ignorance, not caring what the results of his carelessness may be."

Some modifications of this condition have been made recently applying to special cases, but generally the condition operates as above indicated.

PERISHABLE TRAFFIC IN QUANTITIES.

Scale of rates for the conveyance of large quantities by passenger train:—

Miles.	Per Cwt.		Miles.	Per Cwt.		Miles.	Per Cwt.	
	5 cwt. lots.	10 cwt. lots.		5 cwt. lots.	10 cwt. lots.		5 cwt. lots.	10 cwt. lots.
	s. d.	s. d.		s. d.	s. d.		s. d.	s. d.
30	1 0	0 11	90	1 11	1 10	200	2 11	2 10
35	1 1	1 0	100	2 0	1 11	210	3 1	3 0
40	1 2	1 1	110	2 1	2 0	220	3 2	3 1
45	1 3	1 2	120	2 2	2 1	230	3 3	3 2
50	1 4	1 3	130	2 3	2 2	240	3 4	3 3
55	1 5	1 4	140	2 4	2 3	250	3 5	3 4
60	1 6	1 5	150	2 5	2 4	260	3 7	3 6
65	1 7	1 6	160	2 7	2 6	270	3 8	3 7
70	1 8	1 7	170	2 8	2 7	280	3 9	3 8
75	1 9	1 8	180	2 9	2 8	290	3 10	3 9
80	1 10	1 9	190	2 10	2 9	300	3 11	3 10

The "Bulking" System and its Advantages.—The "bulking" system is recommended to the careful attention of all agriculturists as being the means whereby they can effect a considerable saving in the cost of conveyance of their goods, both as regards their produce on the outward journey and their purchases on the homeward journey. The system can be best explained by the following examples:—

Suppose, for the purpose of illustration, that a fruit-grower residing in Evesham has a small consignment of fruit weigh-

ing, say, one hundredweight, to send to London, and that he elects to send it by passenger train. By the scale for such small parcels it will be seen that the railway company's charge would be at the rate of one half-penny per pound, or 4*s*. 8*d*. for the one hundredweight parcel; but if the sender agreed with, say, nine other consignors of one hundredweight lots to "bulk" all their fruit—that is to say, lump all the small lots together and send them as one ten-hundredweight consignment, the rates given in the table on page 725 would apply.

Now, Evesham is situated 106 miles distant from London, so that the consignment would be charged at the rate of 2*s*. per cwt., which means to say that by adopting this method *each consignor would save 2s. 8d. on his respective parcel.*

The principle can be applied equally well to consignments sent by goods train. Thus the following are the railway rates for the conveyance of plums from the Vale of Evesham to London :—

Small lots. per ton. £ s. d.	10 cwt. lots. per ton. £ s. d.	1 ton lots. per ton. £ s. d.	2 ton lots. per ton. £ s. d.	3 ton lots. per ton. £ s. d.
1 8 0	1 3 9	1 2 1	1 0 10	0 19 7

But a rate much higher than any of these may legally be charged under the "small scale for lots under 3 cwt." Here, for instance, are the railway company's charges for the conveyance of three small lots of plums from Evesham to London :—

cwts.	qrs.	lb.		s.	d.
0	2	0	... ...	1	3
1	0	0	... ...	1	11
1	2	0	... ...	2	8

Assume, for the purpose of further illustration, that ten Evesham fruit-growers, each having the small quantity of 1 cwt. of plums to send to London, agreed to bulk their several lots and forward them as one consignment, the railway company is then bound to calculate the carriage in this way :—

cwts.	qrs.	lb.		s.	d.
10	0	0	@ 23s. 9d. per ton	11	11

From this it will be seen that the cost of conveyance of each lot is just under 1*s*. 2½*d*., as against 1*s*. 11*d*. if sent as a single parcel. Obviously, too, the more there are in the combine, the better it will be for each individual, because, as the weight increases, the rate decreases *pro rata*.

Take another example. The rates for apples and pears between Evesham and London are:—

Small lots. per ton. £ s. d.	10 cwt. lots. per ton. £ s. d.	1 ton lots. per ton. £ s. d.	2 ton lots. per ton. £ s. d.	3 ton lots. per ton. £ s. d.
1 3 2	0 17 6	0 16 8	0 15 10	0 15 5

The cost of conveyance of a small consignment of apples weighing, say, 2 cwt. (at the "Small's" scale) would be 2*s.* 4*d.*; but if twenty such lots were bulked and sent forward as one lot, the carriage would be charged at 15*s.* 10*d.* per ton; total, 31*s.* 8*d.*, or 1*s.* 7*d.* per 2-cwt. lot. *In other words, there would be a saving of 9d. in the carriage of each consignment.*

This method of consigning can be employed with equally beneficial results in any district, and in connection with the carriage of many kinds of agricultural produce and requisites. Thus there are two rates for the conveyance of vegetables from Newport, Salop, to London, namely 26*s.* 11*d.* for 1-ton lots, and 33s. 8d. per ton for smaller quantities. A 2-cwt. consignment between these points would therefore cost 3*s.* 4½*d.*; but ten such lots lumped together could be sent for 26*s.* 11*d.*, or approximately 2*s.* 8½*d.* apiece; and low rates for large quantities by goods train have been adopted for cyder, grain feeding stuffs, and manure.

The "Bulking" Principle Welcomed by the Railway Companies.—The railway companies themselves welcome the adoption of this system of marketing by agriculturists. Thus the South Eastern and Chatham Railway Company, in their "Fruit and Vegetable Tariff," give notice to the following effect:—

"When a sender forwards from the same station or siding to the same salesman or market in London a consignment of fruit or vegetables, or a consignment consisting partly of fruit and partly of vegetables, and elects to lump and tender such consignment at one time, the rate or rates applicable to such consignment will be subject to a reduction of 10 per cent. when the aggregate weight exceeds 2 tons, and to 15 per cent. when the aggregate weight exceeds 4 tons.

"The same allowances will be made when a consignment of fruit or vegetables, or consisting partly of fruit and partly of vegetables, is the property of two or more senders, but in such cases one of their number is, by arrangement amongst themselves, to be selected as the nominal sender. His name is to appear as such on the consignment handed to the company, and he is to be authorised by his co-senders to receive, on their behalf, the allowances above referred to."

And the Great Western Railway similarly announce that :—

"The company wish it to be known that if the agriculturists at any point upon their system of railway will co-operate and agree to so aggregate their consignments as to make up reasonable truck loads of the different descriptions of their produce for consuming centres, the company desire to consider the subject with them, with the view of making conveyance arrangements that should enable business to be done. The company will be glad to send a representative to any point upon their railway, to confer with intending senders upon this subject, and to afford such information and advice in regard to conveyance rates and transit as may prove to be required.

"It has been arranged that when a mixed consignment of fresh meat, dead poultry, dead rabbits, butter, eggs, fruit, or vegetables is forwarded by goods train from one station to another station by one consignor or to one consignee (one of whom will pay the carriage), each portion of the consignment, provided that such portion exceeds 3 cwt., will be charged at the actual weight at the rate applicable to the gross weight of the consignment, so that traders will obtain the benefit of lower rates, if the minimum quantity is made up by a combination of the various articles. For instance, a consignment of 3 tons, consisting of 1 ton of fresh meat, 1 ton of butter, and 1 ton of apples, if carried a hundred miles, would be charged as under :—

	£	s.	d.
Fresh Meat	1	4	2
Butter	0	18	9
Apples	0	15	0

and not at the higher rates for 1 ton lots."

Similar notices are issued by the other railway companies dealing with agricultural produce.

It may be well to add, as the fact is not generally known, that when certain kinds of agricultural machinery (which are only carried by the railway companies at the owner's risk) are received in a damaged condition, having been broken in transit, they may be returned to the senders for replacement *free of charge for carriage*. A list of such articles is given hereunder for the information and guidance of the agriculturists :—

Agricultural machines and implements, including agricultural carts and wagons; chaff cutters; corn crushers; oil cake mills; root cutters and pulpers; and other machines for preparing food for agricultural purposes; but excluding harrows, iron; land rollers; clod crushers; horse gearing machinery; steam engines, portable, vertical, or horizontal, in lots under 1 ton; vegetable washing machines.

Where to Inquire.—It would be impossible in an article of this description to mention all the opportunities which exist for effecting economies in the cost of conveyance of goods of

agricultural produce from the various producing centres to their respective markets; but the majority of the companies have literature on the subject specially prepared, and this will be sent on receipt of an application from anyone interested to the General Manager of the company concerned.

THE COMMERCIAL GROWING OF SUGAR BEET IN NORFOLK.

WALTER E. SAWYER.

Having this year superintended the growing of 53 acres of sugar beet, for export for sugar manufacture, a few remarks gained by observation of the various methods adopted by the growers may be of interest. This trial was undertaken purely from a commercial point of view on both sides, and in the case of the growers they were not specially interested in the result from any view but that of profit, they had not to consider the analysis or size of roots, as the contract only stipulated that the seed supplied should be sown and the resulting crop delivered, and no restrictions were made as to cultivation or artificial manures. Thus the farmers had an absolutely free hand.

The variety of seed supplied was "*Kleinwanzlebener,*" and the average yield was between 10 and 12 tons per acre of clean topped roots weighed by rail weights as delivered. In the case of those who really took an interest in the new departure and grew the best crops, the land was generally such as would, with proper attention and manuring, yield a good crop of mangolds. About 10 to 12 loads of farmyard manure were ploughed in after the wheat crop was removed, and the soil was then ploughed twice in the spring, harrowed fine each time, and then ridged in 20- to 24-inch baulks. The sowing was done with the usual mangold drill, and as much seed put on as it was possible to do with the drill by once drilling, namely, about 10 lb. to 12 lb. per acre. Unfortunately the seed was delivered rather late, and so the drilling did not take place until the middle of May. The horse hoes were kept going as soon as the rows were visible, and by the middle of June the plants were cut out and singled about 9 inches apart. Then they were hand-hoed twice and horse-

hoed until the leaves grew so large as to be liable to damage by the horse. They received two dressings of nitrate of soda, about 1 cwt. each time. The cost of the hand-hoeing was about 13*s*. to 15*s*. per acre, inclusive of the cutting out and singling.

The roots were lifted at the end of October and the beginning of November, and this was really the worst and most costly extra work the crop entailed. In the majority of cases it was necessary to hold the leaves and lift them with the help of a fork, and the cost was about 2*s*. per ton, or £1 to £1 5*s*. per acre. They were then thrown into rows, topped, and carted to the station. The general cultivation was in all cases the same as usually practised in Norfolk with a mangold crop, but the cutting out, singling, and lifting were more expensive.

The analysis below is a typical one picked out of five made by Mr. Arthur Ling, F.I.C., F.C.S.

The soil on which these particular roots were grown was good mixed loam with sandy subsoil. The preceding crop was wheat, turnips were thrown out, and sheep folded on the land. Then 10 loads of farmyard manure were ploughed in during the winter; the land was then ploughed twice, harrowed fine, and baulked up 24 inches. About 10 lb. of seed were sown per acre, and 3 cwt. of superphosphate applied at the time of sowing. The total yield of topped roots delivered on rail was 12 tons 11 cwt. per acre.

10 *Roots Examined.*

Average Weight of Root without leaves, 1 lb. 2 oz.

Sugar in roots	16·7 per cent.
Specific gravity of juice	18·5 Brix
Sugar in juice	17·3 per cent.
Non-sugar (apparent) in juice	1·2 ,,
Coefficient of purity (apparent) in juice ...	93·5 ,,

The growers are very well satisfied that they can grow roots of as good as or better quality than can be grown abroad, and given favourable seasons can probably obtain a greater yield. At the same time they are equally certain they cannot grow for export at a profit.

In this case the price was 17*s*. 6*d*. per ton of 21 cwt. (allowance of 1 cwt. for mould attached), free on quay for clean roots, the seed being supplied free. This certainly seemed

at first sight a fair offer, and no doubt was all the foreign manufacturer could afford to offer, as with his expenses of shipping, commission, and sundries the roots cost him some 27*s.* 6*d.* per ton on his side. Then the farmers had the rail charges to pay, averaging about 2*s.* 6*d.* to 3*s.* per ton, and all roots had to be lifted, topped, and carted to the station at short notice at a very busy time, just when all hands are wanted for cleaning the land and wheat sowing. Being a bulky crop the carting was a slow job, about 2¼ tons going to a wagon load, and unless the distance to the station was very short, not many could make more than two journeys per day. As sugar beet certainly does not yield at the most more than half the weight of an average mangold crop, there did not seem to be any financial gain at all, and many found themselves out of pocket over the transaction.

Should a factory be opened in this county, and farmers are offered £1 per ton free on rail, this would enable the factory to obtain its roots at a price which would compare favourably with prices paid abroad. In addition, the farmer would obtain the cheap by-products, such as beet slices and saturation lime. At the price mentioned, therefore, it seems not unlikely that a new industry might be started which would yield a fair return to the farmer.

THE DESTRUCTION OF RATS.

Two kinds of rats are found in Great Britain, the Black Rat (*Mus rattus*), and the Brown Rat, sometimes called the Hanoverian or the Sewer Rat (*Mus decumanus*). The former, which has been longer established in this country, is the smaller of the two. It is more lightly built, but its ears are slightly larger and it has a thin tail eight or nine inches long, or about an inch longer than the rest of its body. The upper part of its fur is of a grey black colour, the under parts being a dark grey. The brown rat is generally longer in the body, but shorter in the tail, which is never as long as the head and body combined. It has a blunter muzzle, and its fur is grey-brown above and white below. The fur of the brown rat, moreover, is rather coarser than that of the black rat.

The females of both species breed at a very early age, and

though they go with young for six weeks they have several litters in the year, each litter comprising from six to fourteen young. Rats therefore increase in numbers very rapidly if sufficient food is available. It has been calculated that in India, where they breed all the year round, the offspring of a single pair would, if supplied with sufficient food and left unchecked, amount at the end of one year to thirty-five thousand. Fortunately such favourable conditions are never present.

Rats are omnivorous feeders, and when desperate with hunger are even cannibals, but they are by choice dependent on the food supplies which man prepares for himself and his domestic animals, or on the waste of such food. Many estimates have been made of the damage done by the rat population of Great Britain in a single year, but as these estimates are based on the assumption that the supplies consumed by rats would otherwise be available for human use or consumption the reasoning is unsound. It is, however, generally admitted that the damage done is incalculable. Rats frequent dwelling houses (generally only the lower floors), barns, granaries, poultry yards, slaughter houses, sewers, and other places where food supplies are stored, or the waste is thrown away. They also frequent rabbit warrens, and take to the fields when food is to be found there, returning to shelter and to breed in corn stacks in the autumn.

Apart from the food consumed by rats, much damage is done to buildings, floors, and other kinds of woodwork from their power of gnawing holes and passage ways. It is also known that the disease called plague may be spread to human beings by fleas from infected rats.

It is, therefore, highly desirable, both from an economic and a sanitary point of view, that rats should as far as possible be destroyed. It would, of course, be well if they could be entirely exterminated in Great Britain, but this is practically an impossibility. During the period of nearly two hundred years that has elapsed since the Brown Rat was introduced into this country, it has penetrated to the remotest parts of the British Islands, and is to be found in many ruined buildings and other places from which it would be difficult to dislodge it. Since rats can live on garbage, travel over wide

areas, and breed very rapidly, a few pairs allowed to remain alive would quickly re-stock the country, and even if every rat were destroyed, others would undoubtedly be imported in some of the vessels that call at English ports. The expense and inconvenience of exterminating the rat population of this country and preventing re-importation would far outweigh the economic gain to be secured by their destruction.

The destruction of rats is essentially a matter for local effort, and the occasion for the attempt to be made is when the danger of injury from their presence outweighs the probable cost and trouble of killing them. Local effort, however, does not necessarily mean isolated or unsystematic effort. In many places it is true that rats can be kept down by cats, traps, and occasional rat hunts, and this is true of most dwelling houses, especially if the kitchen and outhouses are kept in a clean and tidy state so that the rats find it difficult to procure an abundance of food. It is also true of many farms where the buildings are well kept, but in other cases on farms, or in mills, malthouses, and other establishments where large supplies of food are stored, especially where several such buildings stand close together, combined effort is essential. In these cases the formation of a Rat Club such as is described in Leaflet No. 84 is desirable. It is customary in such cases for all the large occupiers of land in a given district, generally comprising several thousands of acres at least, to offer a small reward for every rat killed within the district, the tail being produced as a proof of slaughter. Occasionally, however, it happens that for sanitary or other reasons, especially when rats have been allowed to breed undisturbed for a long time, it is considered important to attempt the extermination of rats over a much wider area, and in this case a more elaborate organisation is required. The following observations and suggestions may be found useful to those who propose to organise such a campaign.

There are three methods which may be employed in the destruction of rats:—(1) Hunting; (2) Trapping; (3) The use of poison or rat virus. There is not much to be said about the first of these methods. Most residents in the country are acquainted with the ratting instinct of terriers, and with the employment of ferrets, and a knowledge of the practice can

better be obtained by experience than by description. As regards traps, the spring trap which kills the rat at once when the spring is released is the best, but care must be taken to see that no other animal is caught, and traps should therefore be visited frequently. Another kind is the wire trap, on the eel-basket principle, which the rat can enter easily when attracted by the bait but cannot leave.

Rat poisons are sold in all country towns by chemists, and several patent or proprietary poisons are advertised in agricultural and other newspapers. They are generally composed of phosphorus paste or arsenic, but strychnine may also be employed, while the use of barium carbonate has also been recommended.* Plaster of Paris is sometimes used mixed with flour, which sets into a hard mass in the rat's stomach. It must be remembered that rats are very suspicious, and if

* A recent bulletin published by the United States Department of Agriculture discusses the relative merits of arsenic, phosphorus, strychnine and barium carbonate as rat poisons. *Arsenic* is cheap, and perhaps the most popular poison for the purpose, but experiment showed that, measured by the results obtained, it is dearer than strychnine. It is variable in its effects. One part of arsenious acid may be mixed with twelve parts by weight of oat or maize meal and made into stiff dough with white of egg. *Phosphorus* is almost as commonly used as arsenic, and is effective when mixed in an attractive bait; but in the paste forms, which contain from one to four per cent. of yellow phosphorus in glucose and other substances, the lower percentage is too small to be always effective, and the larger amount is dangerously inflammable. Many fires have been caused by phosphorus paste in the United States, and the Biological Survey does not recommend its use. It is said that there is no foundation in fact for the statement that phosphorus dries up or mummifies the body without odour when eaten by rats or mice. *Strychnine* may be effectively employed in the open and round farm buildings, but it is too rapid in its action for use in houses, as the vermin would die on the premises. Dry crystals of strychnia sulphate may be inserted in portions of raw meat, sausage or fish, and these placed in the burrows. Strychnine syrup may be prepared by dissolving ½ oz. of the sulphate in one pint of boiling water and stirring in one pint of thick sugar syrup; this may be used to moisten a bait of oatmeal, while wheat or maize may also be soaked in it. In all cases it is advisable that baits containing one of the above poisons should be obtained ready prepared from a pharmaceutical chemist. *Barium carbonate* is considered one of the cheapest and most effective poisons for rats and mice. It is without taste or smell, has a corrosive action on the mucus lining of the stomach, and, causing thirst, induces the vermin to seek water in the open, where they die. In the small doses used it is said to be harmless to domestic animals. It may be employed in the proportion of one part of the carbonate to four parts of meal, mixed to a dough with water. A convenient bait is composed of one part by measure of the mineral to eight parts of oatmeal, mixed to a stiff dough. The carbonate may also be spread on fish or moist toasted bread. In 1905 large quantities of a poisonous food were sent out by the Agricultural Botanical Institute at Munich for the purpose of destroying field mice, and it is stated that it chiefly contained barium carbonate.

they find that any number of their fellows die after eating any kind of food they will avoid such food for some time. It will be as well, therefore, to vary the form and appearance of the poisoned bait at intervals. Thus, after using poisoned bread for a while, oatmeal similarly treated should be used.

Apart from the risk of a possible prosecution under the Acts which deal with the use of poisoned grain, meal, or meat, it is very necessary when using poisons to take precautions to avoid injury to other animals and human beings. (The Acts concerned are the Poisoned Grain Prohibition Act, 1863, and the Poisoned Flesh Prohibition Act, 1864.)

In any case poisoned baits should only be laid by authorised and responsible people. Their whereabouts should be carefully recorded, and they should be visited regularly and destroyed if not taken within a short period. The strictest precautions should be taken to prevent the bait being eaten by domestic animals, and if necessary notices should be exhibited in places where baits are laid to warn people to keep dogs or other animals away from the place. When poisoned baits are laid by a Rat Club or other organisation, it would be as well to insist that each group of baits should be numbered, and its situation, success, or failure and ultimate destruction recorded in a book.

Rat viruses, on the other hand, of which there are several on the market, can be used without fear of direct injury to any animals other than rodents. These viruses are believed to be composed in every case of a culture of a microbe causing a specific disease of rats, which in some cases at any rate is contagious, so that the inoculated rat conveys the disease to his fellows. The uncertainty with which this method is attended is due partly to the difficulty of securing a successful infection in all cases, and partly to the fact that, if only slightly infected, rats recover and thereafter become more or less immune to the disease.

It cannot be too strongly urged, therefore, that if there is to be a successful attack upon rats in any district, reliance should not be placed in any one of the methods referred to above, but that as far as is possible under the circumstances *all these methods should be employed.* Rats are intelligent animals, and will soon learn to evade any one of these devices,

and will even vacate for a time the district in which they are being harried. If, therefore, it is proposed to exterminate the rats in a large district, means should be employed whereby this intelligence can be used to compass their destruction. With this object combined efforts should be made over a wide area, and the attack made in a circle radiating from a given spot in which it is considered that the final work of destruction can be accomplished with least difficulty. Rat hunts should be organised simultaneously on the circumference of this circle, traps and poison should be laid on the outside and food supplies in the centre to which the rats should be driven. Every precaution should be taken to see that no rats escape outwards, and their holes should be closed, and their runs and nests destroyed as the circle is gradually drawn closer. Finally, when a broad band at the circumference has been cleared, poisoned food should be employed in the centre, and virus laid where the rats can take the disease.

The Prussian Horticultural Institute at Geisenheim.

One of the Board's Inspectors, Mr. A. H. Lees, spent some time during the past summer at the Prussian Institute for Wine, Fruit, and Garden Culture, at Geisenheim, and has furnished the Board with the following account of the work at the Institute and at the Experimental Station, which is attached to it.

The object of this Institute, which has been in existence since 1872, is to give complete theoretical and practical instruction in the cultivation of the vine and of fruit, vegetables, and flowers. A good deal of attention is devoted to the wine industry, and instruction is given in the processes involved in the manufacture and storage of wine, and also in the utilisation and disposal of fruit. The prospectus states that it is the object of the Institute to educate its pupils in such a way that they may not only be well taught in the theory of the subject, but that they may also thoroughly master the practice, in order that they may be able later on to pursue their calling in a rational manner. For this purpose theoretical teaching and technical instruction go hand in hand.

The scientific research and experimental station which is

attached to the Institute is intended to further the practical aims of Wine, Fruit, and Garden culture by means of scientific investigations.

The Institute is quite independent of all other experimental stations in Germany, and is subject only to the jurisdiction of the Prussian Minister for Agriculture in Berlin. It receives from the State an annual grant which amounted in 1907 to £5,850, the balance of its expenditure, viz., about £3,000, being chiefly made up of the fees paid by students.

The actual educational work falls under four heads:—(1) An elementary course of instruction; (2) An advanced course of instruction; (3) Various short courses; and (4) The acceptance of "Praktikanten," *i.e.*, qualified persons who wish to work in the laboratories.

Elementary Course.—The elementary or "one year lower course of instruction for wine, fruit, and garden culture" includes the following subjects:—

Elementary fruit culture, vine culture and wine storing (Kellerwirtschaft), garden culture, and agriculture; surveying; elementary botany and physics; soils and manures; insect and fungus pests; book-keeping and business training.

This course is primarily intended for gardeners and others who intend to practise horticulture for a living. Students taking the two-year course go through this course in their first year.

Two-Year Course.—The two-year course is practically an advanced course on the same subjects. It is more especially intended for those who hope to become teachers in gardening colleges, in schools for vine and fruit culture, or intend to be travelling teachers or experts.

Short Courses.—These comprise: (1) A course of about three weeks for fruit and garden culture for clergymen, teachers, owners of gardens and landed property; (2) One week's course in fruit utilisation for women; (3) A similar course for men; (4) Instruction in the treatment of phylloxera (three days); (5) A fourteen-day course in wine-fermentation, use of yeasts, diseases of wine; and (6) A fourteen-day course in chemical research of wines and treatment of wine.

Experimental Laboratories.—There are three distinct laboratories: (1) The Chemical, or, as it is called, the Vino-

chemical Laboratory, which is chiefly concerned with the chemistry of wine; (2) The Physiological Laboratory, which deals with the physiology of plants; and (3) The Laboratory or experiment station of plant pathology (*Pflanzenpathologische Versuchstation*).

Plant Pathology Experiment Station.—This portion of the Institute deals with plant diseases, whether organic or inorganic. Its work may be considered under three main headings:—(a) Diseases sent in from outside for identification; (b) Diseases that make their appearance in the grounds of the "Anstalt"; and (c) Diseases common to the countryside that call for special consideration as regards preventive and remedial measures.

Every day material is sent in by occupiers in the district, and thus a knowledge is gained not only of what diseases are present and where they are present, but information is also obtained of the appearance of new diseases.

For instance, at the time of my visit American gooseberry mildew was known to exist at Bonn, but had not been heard of in Geisenheim. Bonn is not far from Geisenheim, and it seemed very likely that the disease would soon be brought into the Geisenheim district without the Institute being aware of it. On formulating this question I was told that this was very unlikely, as, owing to the confidence which the growers have in the Institute, they invariably send up any plants that appear to be attacked by an unknown disease. There is, however, no compulsion to report this disease.

There is no doubt as to the origin of this feeling of confidence. The Institute is continually carrying out experiments on various diseases which require elucidation, and this first-hand information is made accessible to the people by means of cheap leaflets, and more especially by the system of travelling teachers that exists in Germany.

The ordinary gardener is thus brought into close contact with the Institute, with the result that not only does he understand to some extent the work that it is doing, which is enough by itself to give him a feeling of confidence, but his needs are understood by the Institute, and information about disease prevention, which might otherwise be only theoretical, is adapted to his needs, and, in a word, is made *practical*. It is to the

feeling that he receives the latest first-hand information that I ascribe the good relations existing between the Institute and the growers. The actual experimental work is, of course, largely governed by the needs of the region in which it is situated. Geisenheim is in the midst of an important vine-growing region, so that diseases of the vine form an important part of the work.

Among the diseases that make their appearance in the grounds of the Experiment Station, and which, without being epidemic in form, nevertheless cause a varying amount of damage annually, the following are mentioned in the yearly report for 1908:—American Blight of Apples (*Schizoneura lanigera*), Smaller Winter Moth (*Cheimatobia brumata*), Vine Weevil (*Rhynchites betuleti*), Big Bud (*Eriophyes ribis*), Fusarium Disease of Beans (*Gloeosporium fagicolum*). In addition, many other insect and fungus pests were dealt with in the course of the year.

Among the diseases common to the countryside, which are regarded as calling for special consideration as regards preventive and remedial measures, are the following epidemic diseases, which have been introduced from other districts:—

The True Mildew of the Vine (*Oidium Tuckeri*), the False Mildew of the Vine (*Peronospora viticola*), the Vine Louse (*Phylloxera vastatrix*), American Gooseberry Mildew (*Sphærotheca mors-uvæ*.)

To illustrate the methods adopted, I may instance the case of *Peronospora viticola*. In all the countries of Europe where this disease of the vine has been introduced almost all, if not the entire crop, would be lost were the vines not regularly sprayed with Bordeaux mixture. This spraying must add very considerably to the expense of cultivation, but the German growers know perfectly well that without this treatment the crop would be a complete failure. One spraying is not nearly sufficient. One such plantation which came under my notice was in a miserable condition, scarcely a leaf being unmarked by the disease in July. It will be understood, therefore, that vine spraying is a costly affair, and any methods tending to make it more effective or less costly would be of great benefit to the community. It was on this problem that the station was engaged at the time of my visit. It is not

necessary to enter into technical details, but it may be mentioned that the problem was attacked by carefully designed field experiments, backed up by work in the laboratory.

As soon as one begins to study plant diseases in Germany it is apparent that they can be divided into three classes: (a) Those common to England and Germany and of equal intensity in both countries; (b) Those common to both countries but worse in one country than the other; (c) Diseases that occur in Germany and which might be exported to England.

The majority are of the first class, and their discussion is of only technical interest. The second class includes many interesting cases, such as that of *Anthonomus pomorum.* This insect, commonly called the Apple Blossom Weevil, does not appear to do much damage in Germany, though in England it is a pest that annually causes a large loss of the apple crops in certain regions. The allied form, however, *A. pyri*, which attacks the buds of pear trees, appears to be fairly serious, but does not occur in England. Other somewhat similar examples might be quoted.

The third heading includes those diseases which have the most interest for English growers. Of these, perhaps the two most important are *Diaspis fallax* and *Rhagoletis cerasi.* The former, a scale insect called *die rote austernförmige Schildlaus,* is an important disease of pears, especially of espaliers. A native of the south, it came to Geisenheim and to South-West Germany about thirty years ago. It is common now in France, and has recently been reported from Holland. It attacks the older twigs and boughs, and in fact any part of the tree where cork formation has already taken place. It also occurs on the fruit. The disease shows its virulence in the sickly appearance of the trees and in characteristic depressions or "*eindellungen*" in the large boughs. Both male and female larvæ, before secreting their true scale, are covered with waxy thread, which renders them very easily transportable by the wind, and facilitates their spread throughout a plantation. *Diaspis fallax* is essentially a southern scale insect, and it is unlikely that it would thrive even if introduced into England. Still it is an insect that should be looked out for, since it is capable of inflicting severe injury under certain conditions.

The Cherry Fly (*Rhagoletis cerasi*) is now included in the Board's Destructive Insects and Pests Order of 1910. It is a serious pest of cherries in Geisenheim. The female fly lays her eggs in the flesh of the cherry. The larva, which is a maggot in form, remains in the fruit for three or four weeks, and partly consumes the flesh. Cherries attacked are said to show a small brown scar, but in those that I saw this was not very obvious. About the time the cherry is ripe the larva is ready to leave the fruit. It reaches the ground, where it forms a pupa, in which state it remains over the winter, to emerge the next spring as a fly.

This insect has become a serious pest in the Geisenheim region; indeed to such an extent that local people will not eat cherries. They are, however, sold elsewhere. No method has been found so far of checking its ravages, as its life-history presents no stage which can be economically attacked. In view of the seriousness of the damage done and the difficulty of finding remedial measures, a sharp look-out should be kept by English growers for its appearance in English fruit.

Experiments in the Improvement of Wheat.

Reference has been made in this *Journal* (*Summary of Experiments,* Vol. XVI., 1909, p. 65) to the experiments which have been in progress for some years with a view to the production by hybridisation of a "strong" wheat suitable for growth in this country. It will be remembered (*Journal,* Vol. XI., p. 321) that a "strong" wheat is one which gives a flour capable of producing a larger and more shapely loaf than that derived from a weak wheat. Most of the high-yielding wheats grown in the United Kingdom are weak as compared with foreign grown varieties, such as "Fife," and, consequently, fetch a lower price in the market than the latter. The strong wheats of Canada or Russia, when grown in this country, prove, however, to be very poor croppers. The object of the experiments was to effect, by the application of Mendelian methods, a new combination of qualities, and to produce a strong wheat capable of giving as heavy crops as the indigenous soft wheats of the country.

A circular recently issued by the Home Grown Wheat

Committee announces that success has been attained, a result which is highly creditable to the Cambridge School of Agriculture, where the work has been carried on. From a cross between Red Fife and Essex Rough Chaff has been produced a hybrid named Burgoyne's Fife, which the Committee have subjected to tests on a large field scale on various soils in different parts of the country, with the result that they have made the following report:—

"The Home Grown Wheat Committee of the Incorporated Association of British Millers recommend the distribution of Burgoyne's Fife as an improvement on any known variety of English wheat so far as quality is concerned, and as a wheat which is likely to succeed as regards yield under many conditions, both for autumn and spring sowing."

A large stock of this wheat has been distributed for sowing this autumn at a price of 10*s*. per bushel. The proceeds have been handed over to the Agricultural Department, Cambridge University, to aid further research work concerning wheat.

In this connection it is interesting to notice that great progress has been made in determining what the chemical conditions are which distinguish a strong wheat from a weak one. The evidence available now points to the conclusion that strength is correlated with the proportion of mineral constituents—especially phosphates—in the grain. It is well known that the husk of wheat ("bran") contains a large proportion of these mineral constituents, and the complete removal of the bran by modern milling machinery is sometimes deplored on the ground that these mineral constituents are of great dietetic value. It has been found that flour treated with an aqueous extract of bran shows an increase of strength, that is, it gives a larger and better-shaped loaf. Further, flour treated with a solution of the salts found in bran is similarly improved.

The spraying of flour during milling with various solutions is now a recognised commercial process, and inasmuch as the substances so added (*e.g.*, phosphates) are of recognised dietetic value, there can be no objection to the new development from a sanitary point of view. The result is to produce a loaf with all the dietetic value of "brown" bread, coupled

at the same time with the absence of the indigestible fibre which forms such a large proportion of the bran.

Poisoning of Animals by Potatoes.

Two cases of poisoning of animals caused by raw potatoes, which have recently occurred in Germany,* would seem to indicate that care must be exercised in feeding farm live stock with large quantities of raw tubers. In the first case a herd of 64 cattle developed symptoms of poisoning after being fed upon a large quantity of raw potatoes, and in the second case two cows were taken ill after feeding upon potato parings. A noticeable feature in both instances was the appearance of eczema on the hind legs, causing lameness. It would appear from these results that potatoes should be steamed before being fed to animals, though an instance is mentioned by Sir J. McFadyean † where poisoning occurred, even when the potatoes had been steamed. Eleven horses all died within three days under exceptional circumstances, and the cause was traced to a diet of spoiled steamed potatoes, the first symptoms noticed in ten cases being weakness and loss of power over the limbs. The potatoes had been stored for some time previous to feeding, but were not sprouted to any considerable extent. Some of the horses had been receiving potatoes for ten or twelve days, and others for only three or four days. It was proved that death was not due to mineral poison, nor to anything in the nature of infection from organisms, since the potatoes had been steamed. It was conjectured that the poison was probably some organic substance generated by the bacteria or fungi which were growing in the decaying potatoes.

State Aid to Agriculture in the German Empire.

The Board have been supplied through the Foreign Office with statements showing the expenditure of the various States of the German Empire in respect of agriculture and allied industries. The figures are for one recent financial year, the particulars of which were available, and represent the more

* *Berliner Tierärztliche Wochenschrift*, 1909, No. 40.

† *Journal R.A.S.E.*, 1897, Ann. Rept. from Principal of Royal Vet. Coll., 1896.

or less permanent annual expenditure. This is supplemented in some States by "extraordinary" grants, which, either on account of their temporary character or for some other reason, are not included in the permanent expenditure.

Recurring Expenditure.	Prussia.	Bavaria.	Kingdom of Saxony.	Württemburg.	Baden.	Hesse.	Alsace-Lorraine.	Other States.
	£	£	£	£	£	£	£	£
General administration	701,445	—	1,000	3,734	—	—	—	—
Agricultural teaching institutions and other scientific and educational purposes ...	191,010	37,449	12,374	14,463	10,499	12,155	12,673	6,175
Veterinary high schools and other veterinary expenses	271,435	50,902	—	11,889	1,107	—	9,300	1,436
Promotion of stock-breeding	234,600	108,187	14,693	25,295	17,094	—	17,600	9,024
Promotion of fisheries...	25,392	973	—	325	—	—	584	119
Land improvements, moors, banks and dunes	166,667	45,314	—	15,764	—	24,471	—	362
Promotion of the cultivation of fruit and wine and horticulture ...	13,750	4,500	500	7,051	75	—	3,350	210
Funds for supporting agricultural corporations, societies, &c., including insurance, credit societies, and trades' unions	36,250	27,878	—	16,625	11,389	400	4,000	2,982
Promotion of agriculture in general and miscellaneous expenses	31,653	18,250	16,800	3,773	3,382	18,207	5,395	28,182
Total	1,672,202	293,453	45,367	98,919	43,546	55,233	52,902	48,490

In the case of Prussia, the large item of £701,000 for General Administration includes the salaries and expenses of the staff of the Ministry of Agriculture, Forestry, and Domains, the Supreme Court of Agriculture, and of the General Commissions. The Commissions authorise the advancement of money to small farmers for the purchase of land, and deal with questions of communal rights, division of property, charges on land, &c.

The grants made in respect of the salaries and expenses

at the Agricultural and Horticultural Colleges at Berlin, Bonn-Poppelsdorf, Bromberg, Proskau, Geisenheim, and Engers amount approximately to £72,000, the balance of the sum allotted for agricultural education being made up of grants to agricultural secondary schools, continuation schools and courses, and funds for scientific and teaching purposes.

The sum of £271,000 for veterinary matters includes £31,000 for the Veterinary High Schools at Berlin and Hanover, but the bulk of this amount is accounted for by the cost of the local veterinary service, *i.e.*, the salaries and expenses of 36 departmental and 476 district veterinary surgeons, and the inspection of meat passing through the inland custom houses.

The outlay on cattle and horse breeding, which amounts to £234,600, is made up of four sums, the largest being one of £150,000 for prizes for horse races, towards which £138,800 is contributed from the betting taxes. The breeding of horses is promoted by prizes or premiums for rearing stallions and mares belonging either to societies or private individuals, and also by premiums for the importation of thoroughbreds for stud purposes, the sum allotted for these purposes being £30,000. The promotion of poultry breeding, especially on peasant farms (£6,750), is also included under this head, as well as a general grant of £47,500 for promoting the breeding of other farm animals and for the encouragement of the dairy industry.

The supplementary grants in Prussia for 1910 amounted to £400,000, and the total vote for the Ministry of Agriculture in that year was £2,072,202.

Production of Sulphate of Ammonia.

The report of the Chief Inspector of Alkali, &c., Works for 1909 (*H.C.* 191, 1910), shows that there were 536 works or separate processes for the manufacture of sulphate or muriate of ammonia in England and Wales. The number has steadily increased from 449 in 1904. In Scotland the number of such works was 101. There were also 55 gas liquor works in England and six in Scotland. Sulphate of ammonia is chiefly obtained as a bye-product

from coal. When this is treated for the production of coal-gas or for the manufacture of coke used in iron smelting, an "ammoniacal liquor" results, which forms the raw material for the manufacture of ammonium salts. The distillation of the bituminous shales used in the Scotch paraffin industry also yields a certain amount, and the ammonia produced in other manufactures in which coal and similar substances are used, in iron works, from producer gas plants, and from carbonising works, is also collected. The quantity of sulphate of ammonia produced in the United Kingdom is shown in the following table:—

Source.	1909.	1908.	1907.
	tons.	tons.	tons.
Gas works	164,276	165,218	165,474
Iron works	20,228	18,131	21,024
Shale works	57,048	53,628	51,338
Coke-oven works	82,886	64,227	53,572
Producer-gas and carbonising works (bone and coal)	24,705	24,024	21,873
Total	349,143	325,228	313,281

About one-third of this quantity is produced in Scotland. The supply from gas works does not vary much, but all other sources show an increase, that from coke ovens, over 18,000 tons, being very marked. In 1904 the production in coke-oven works was only 20,000 tons. The total production in 1909 was 349,000 tons, and 264,000 tons were exported, so that the balance remaining for home consumption for all purposes amounted to 85,000 tons, as compared with 91,000 tons in 1908.

In the table below are shown the imports of the materials used in the trade, the principal being mineral phosphates. A proportion of the nitrate of soda imported is used in the manufacture of sulphuric and nitric acid.

	1909.	1908.	1907.
	tons.	tons.	tons.
Guano	20,321	34,417	31,278
Mineral phosphates	451,807	529,135	504,671
Nitrate of soda	90,207	145,724	113,894

The number of chemical manure works under inspection in 1909 was 164, as compared with 167 in 1907. In Scotland the chemical manure works numbered 38, one less than in 1908, and the production decreased to 53,464 tons, a lower figure than in any year since 1897.

Calf-Rearing.

The only branch of British farming which has not up to the present been exposed to foreign competition is that of milk production. Attempts have been made at different times to import fresh milk from adjacent parts of the Continent, but the obvious difficulties in the way have proved too great to be overcome, and the quantity thus received is insignificant. Not only does the British farmer enjoy in this way a monopoly of the trade in milk, but the trade is one which of necessity increases with the growth of the population. In all probability there has been a reduction in the quantity of butter and cheese produced, with the result that an additional amount of milk has become available in a raw state, but, broadly speaking, a necessary accompaniment to an extension in the milk trade is an increase in the number of cows. As a matter of fact there has been a small but continuous extension in the stock of cows and heifers in Great Britain for several years past, but in 1910 the numbers of cows, heifers, and calves all showed a decline. This fluctuation is no doubt of a temporary character, due to the somewhat high prices of meat prevailing in 1909, which may have led to some additional slaughtering, but it certainly suggests that there is likely to be a demand for cows and heifers to fill the vacancies thus caused.

Inquiries which the Board have made do, in fact, appear to show that an increasing demand for dairy cows is noticeable at the present time, and farmers will do well to consider the desirability of rearing more heifer calves with a view to providing for the future.

Custom varies in this respect very greatly in different parts of England. In some districts where dairy farming is largely carried on all promising heifer calves are reared, but in others a large proportion of the heifer calves are sold for slaughter, though this depends on the state of the market. If milking cows are up in price, which is usually in consequence of beef

being dear in the spring, and half-fat cows being in demand for slaughter, heifers are put to the bull instead of being fed, and more heifer calves are reared with a view to selling them later as calving heifers should the price of milking cows be maintained; otherwise they are fed.

At present heifer calves are fetching good prices in many districts, and when exposed in the markets are usually bought by farmers for rearing as cows, rather than for fattening. At the same time there is room for improvement in the general practice. On milk farms especially, calf-rearing is frequently entirely neglected as interfering with the main business—the production of milk—and the calves are either killed soon after birth or sold at a small price shortly afterwards. This is obviously a very wasteful system, and an effort should at least be made to rear the heifer calves of good cows.

The Board have issued a leaflet (No. 142) on the subject of Calf-Rearing, copies of which can be obtained on application. This leaflet contains advice as to feeding with separated milk and various cream substitutes, and also gives directions for making calf meals or milk substitutes, to be used with a small quantity of new milk.

It is recognised that a difficulty arises on milk-selling and cheese-making farms where separated milk is not available; but as is shown in the leaflet referred to calves can be reared by using a small proportion of new milk, and a carefully compounded milk substitute. With several calves the quantity of milk used becomes an appreciable item, and in such cases it would often be worth while to separate some of the milk and sell the cream, or convert it into cream cheese (see leaflet No. 179) in order to provide a supply of separated milk for the calves.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

Miscellaneous Experiments.

Rotation Experiments (*Northumberland C.C. Educ. Com., Bull* 14, *Guide to Experiments at Cockle Park for* 1910).—In the Back House Field rotation experiment the fourth rotation was begun in 1909 with

* The summaries of agricultural experiments which have appeared in the present volume have been as follows:—Cereals, April; Cereals and Root Crops, May; Root Crops, June; Root Crops and Potatoes, July; Grass and Clover, August; Cereals, September; and Miscellaneous Experiments, October and November. The Board would be glad to receive for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

the swede crop. In the last rotation, the highest increase in the crop over the unmanured plot was made on a plot on which 10 tons per acre of farmyard manure were given to the root crop, and complete artificials to the hay. Though the plot again did well in 1909, the best results were obtained from the application of 10 tons of dung and 3 cwt. complete artificials, both to the root and the hay crops.

In another experiment, five miniature farms are laid out, each consisting of four plots, $\frac{8}{45}$ of an acre in area. They are worked on a four-course rotation, and manured alike, with the object of finding the total produce obtained with five different systems, viz.: selling off barley, feeding linseed cake to cattle, applying nitrate of soda, selling half the hay, and feeding all produce to cattle. The results for the years 1903–9 are given in this report.

Calcium Cyanamide and Nitrate of Lime (*Aberdeen and N. of Scotland Coll. of Agric., Leaflet No.* 9).—These two manures have been tested during three years on the potato crop, on fifteen farms. A dressing of superphosphate and potash manure was applied to all the plots, and the two new nitrogenous manures, together with sulphate of ammonia and nitrate of soda, in quantities sufficient to provide the same amount of nitrogen in each case, were compared. The results from sulphate of ammonia, nitrate of lime, and nitrate of soda were very similar, but the yield from calcium cyanamide was somewhat less.

A similar experiment was carried out in 1909 on hay. Each plot was top-dressed at the rate of 40 lb. phosphoric acid, 30 lb. potash, and 20 lb. nitrogen per acre, the last being supplied by 1 cwt. sulphate of ammonia, 1 cwt. calcium cyanamide, $1\frac{1}{2}$ cwt. nitrate of lime, or $1\frac{1}{8}$ cwt. nitrate of soda.

The results from these two experiments appeared to show that calcium cyanamide and nitrate of lime are suitable sources of nitrogen for potatoes, and that nitrate of lime may take the place of the older manures for top-dressing hay. Calcium cyanamide is unsuitable for grass land, and was only included for comparative purposes.

Nitrate of Lime as a Top-dressing for Oats (*Northumberland C.C. Educ. Com., Bull.* 14, *Guide to Expts. at Cockle Park for* 1910).—Three $\frac{1}{3}$-acre plots of oats were top-dressed, with the following results:—139 lb. nitrate of lime ($17\frac{1}{2}$ lb. nitrogen), $46\frac{3}{4}$ bush.; 112 lb. nitrate of soda ($17\frac{1}{2}$ lb. nitrogen), 38 bush.; no top-dressing, 31 bush.

Influence of Magnesia on Wheat and Potatoes (*Jour. Roy. Agric. Soc., Vol.* 70, 1909).—Pot-culture experiments appeared to show that, as the proportion of magnesia to lime in the soil increased, the crop suffered in growth, and the grain underwent modification, and in 1908 experiments to test the point on a field scale were started. Magnesia (MgO) was applied to wheat at the rates of 3 cwt. and 6 cwt. per acre. No marked results were produced in the weight of the crops, but milling and baking tests indicated that as the amount of magnesia increased the inferiority of the grain became more marked. The 1909 crop on the same land was top-dressed with $1\frac{1}{2}$ cwt. per acre of magnesia ground fine, and the results from the plots on which 6 cwt. had been applied the previous year gave an indication of the tendency of magnesia to reduce the crop. The grain from these plots was again valued at a lower figure.

With the potato crop similar results were obtained in 1909, the crop being reduced when magnesia, carbonate of magnesia, magnesian lime, and magnesian limestone were applied in quantities of from 3 to 10 cwt. per acre. These results did not bear out the conclusions arrived at from experiments in 1908, which seemed to show that magnesia would be a useful dressing for potatoes.

Inoculation Experiment (*Jour. Roy. Agric. Soc., Vol.* 70, 1909).— Field experiments in inoculating lucerne and white clover with Nitro-bacterine were begun in 1908. The lucerne, however, was attacked by a fungus disease, and the plots had to be given up. Two varieties of white clover were sown in 1908—Dutch white and "Mammoth white." The seed was inoculated, and in 1909 the treatment was repeated by spreading on the plots soil which had been treated with Nitro-bacterine preparation. No striking results have followed the inoculation in either case.

Pot-Culture Experiments (*Jour. Roy. Agric. Soc., Vol.* 70, 1909).— Experiments are in progress as to the influence of lithium and potassium salts on wheat. The presence of minute quantities of lithium in the soil has been shown to be harmful.

Green manuring.—The object of this experiment is to explain the results of field experiments in green manuring, in which the ploughing in of a non-leguminous crop like mustard has produced a better manurial effect than the use of a leguminous crop like tares. This has apparently been due to the soil being left after the mustard crop in a better condition for retaining water than after tares. Soil was taken from the plots on which tares and mustard had been ploughed in green in 1907, and three colloidal substances—silicate of alumina, silicate of soda, and kaolin—were added to it in order to see whether they would alter its physical condition and enable it to retain moisture better. The addition of silicate of alumina resulted in a very large gain, and this was more marked with the tare soil than with the mustard. Silicate of soda also gave an increase, though not so large a one, while kaolin had no effect. Lime and magnesia were also added to pots of the soils in order to test their effect in rendering the nitrogen available.

Influence of Magnesia on Soils.—Previous experiments had shown that magnesia applied to Stackyard Field had very marked effects on the wheat crop in accordance with the proportion of magnesia to lime in the soil. When the proportion of magnesia exceeded that of lime the crop was decreased, while the grain was changed from "soft" or starchy to "hard" or glutinous.

Further experiments in 1908 showed that the insoluble forms of magnesia may be used with advantage so long as the proportion in the soil does not exceed that of lime. The effects on the grain were distinctly marked, it being more glutinous and less starchy.

Artificial Fertilisers on Fen Soil.—The black fen soil of the Isle of Ely is very rich in nitrogenous organic matter, and it is unusual in practice to use any nitrogenous artificial manure on it, lest the crop should "go down." This experiment was devised to ascertain whether small dressings of nitrogenous manures with minerals would be advantageous and would bring about a better consolidation of the soil. The results suggested that this would be the case, substantial increases

both in grain and straw being obtained by the application of superphosphates, potash, and nitrogen in various forms.

The Cure of Soil Acidity.—The soil on a plot at Woburn, which has been manured continuously for many years with sulphate of ammonia for barley, has become too acid to grow a crop. An attempt was made in this experiment to remove this acidity by oxidising materials, such as sulphate of iron, sulphate of copper, pyrogallic acid, and animal charcoal. None of these materials proved successful.

Inoculation of Leguminous Crops.—Ordinary white clover, mammoth white clover, red clover, and lucerne were inoculated with Nitro-bacterine. The difference between the inoculated and uninoculated crops was too small to allow of any deductions being drawn.

The Relative Amounts of Dry Matter in Varieties of Swedes (*Proceedings of the Univ. of Durham Philosophical Soc., Vol. III., Pt.* 5). —In this paper the results of many experiments that have been carried out to test the amount of dry matter in different varieties of swedes at the Armstrong College are classified and compared. The method usually adopted has been to sow the seed of the varieties in the same field with the same manure, several drills of one variety being followed by several drills of another variety. When the swedes are ready for pulling cores are taken from moderate-sized roots with a sampling iron. Two lots of fifty such cores are dried at a temperature of 55° to 60° C., and analysed. The percentages of dry matter found in the different varieties are averaged and the individual varieties classified according to their difference from this average. Tables are given showing the method of co-ordinating the percentages found in different sets of experiments, and the probable error in the figures. The order of merit of some varieties as regards percentage of dry matter, and their difference from the average, is given in respect of 582 analyses made in different parts of Great Britain.

Manuring of Grass Land (*Expts. at Kineton, Warwickshire,* 1910). —These experiments have been carried out since 1901 by Mr. Ernest Parke, J.P., with the co-operation of Dr. Bernard Dyer. Where phosphates or phosphates and potash salts have been continuously applied without nitrogen the growth of plants of the clover kind is most conspicuous; while on the plots on which nitrate of soda has been continuously used without phosphates or potash, the grasses, as distinguished from clovers, are most prominent. The best herbage, however, in which clovers and grasses appear to flourish with equal vigour and luxuriance, is found on the plots on which phosphates and nitrate are used every year. A full account of this experiment, showing the results of nine years' manuring, was given in the *Journal,* October, 1909, p. 592. It has been continued with the same manuring in 1910, and results on similar lines have been obtained.

Miscellaneous Expts. with Crops (*Shepton Mallet Grammar School, Rept.,* 1909).—Demonstrations on the manuring of mixed grasses without clover, mangolds, and broad red clover, have been carried out on the same ground for ten years. Nitrogenous manures were omitted in 1909, and there was found to be an appreciable residue left in the soil from the manuring in previous years with sulphate of ammonia and nitrate of soda, while the latter did not appear to have had the

exhausting effect usually attributed to it. Continued applications of superphosphate without lime on one plot appear to have made the soil rather acid. The results with broad red clover demonstrate the want of potash in this soil.

Trials were also made of the germination of various vegetable seeds of different ages and sown at different depths, and also with very small potato sets.

EXPERIMENTS WITH LIVE STOCK.

Feeding of Cattle with Soy Bean Cake (Edin. and E. of Scotland Coll. of Agric., Bull. 21).—In this experiment soy bean cake was compared with linseed cake by feeding equal weights to cattle. Analyses of the foods used are given in the report. The linseed cake used contained about 30 per cent. of albuminoids, 8 per cent. of oil, and 33 per cent. of carbohydrates; the soy bean cake contained about 40 per cent. of albuminoids, 6 per cent. of oil, and 28 per cent. of carbohydrates. A mixture compounded as far as possible of soy beans and soy bean cake to give the same analysis as linseed cake, and one lot of soy bean cake, containing over 11 per cent. of oil, were also tested. The cattle were two-year-old Irish bullocks, such as are extensively used for fattening in the east of Scotland. The trials were made at two centres, and the results of each are given separately, as the conditions were not exactly alike.

At Pitskelly three lots of eight bullocks were put up on November 17th, and fed till ready for the fat market. All the lots did not become prime equally quickly so as to be ready for slaughter at the same time, but the comparisons are made on the increase in live weight during the time the lots remained unbroken, viz., 121 days. The three lots were all fed with the following ration per head per day:—85 lb. swedes, $8\frac{1}{6}$ lb. oat straw, which was partially replaced during the last four weeks with hay, and 4 lb. Bombay cotton cake at first, decreasing to $3\frac{1}{2}$ lb. To this the feeding stuffs on trial were added, 2 lb. per day at first, gradually increasing to 5 lb. Lot I. got linseed cake, Lot II. soy bean cake, Lot III. a cake made from soy bean cake and soy bean meal, with a little maize and locust bean meal, so as to give the same analysis as linseed cake. The prices of the cakes were:—Linseed cake, £9 per ton; soy bean cake, £6 15*s.* per ton; compound cake, £7 10*s.* per ton. The increases in live weight made by the three lots were as follows:—

	Average wt. at start. Per head.	Live-wt. increase. Per head.	Cost per cwt. of live-wt. increase.
	cwt. qr.	cwt. qr. lb.	£ *s.* *d.*
Lot I. (Linseed Cake)	8 2	2 1 16	1 16 4
,, II. (Soy Bean Cake)	8 $1\frac{1}{4}$	1 3 25	1 18 1
,, III. (Compound Soy Bean Cake)	8 2	2 0 5	1 19 2

The cost of the increase is calculated by taking the cost of the whole food, not of the cakes alone.

At the second centre, Spencerfield, the experiment started on December 3rd, and lasted till April 11th, when the cattle were sold in the fat market. It was carried out on the same lines, but the food differed slightly. The cattle got 15 lb. more swedes per day, and $\frac{1}{6}$ lb. less oat straw, and the Bombay cotton cake remained at 4 lb. through-

out. Of the special cakes, a soy bean cake containing 11 per cent. of oil was substituted for the compound cake. An additional lot of black and blue-grey polled cattle were given linseed cake. The following results were obtained:—

	Average wt. at start. Per head.	Live-wt. increase. Per head.	Cost per cwt. of live-wt. increase.
	cwt. qr.	cwt. qr. lb.	£ s. d.
Lot I. (Linseed cake)	8 $3\frac{3}{4}$	2 1 21	2 2 0
,, IV. (,,)	8 $1\frac{3}{4}$	2 1 14	2 3 0
,, II. (Soy bean cake)	8 $3\frac{3}{4}$	2 1 18	1 17 0
,, III. (Soy bean cake—11 per cent. oil)	8 $3\frac{1}{2}$	2 1 9	2 0 0

While at Pitskelly the linseed cake was the most profitable, here the soy bean cake was superior to it. This is considered to be due to the inferior quality of the linseed cake, which was deficient in oil, and gave evidence of having been made from badly cleaned inferior seed. The relative position of Lots II. and III. is in agreement with the results obtained at Pitskelly. There the compound soy bean cake with over 8 per cent. of oil did worse than the one containing 6 per cent., and here the latter has done much better than the one containing 11 per cent. of oil.

The conclusions drawn from these two experiments are:—(1) That soy bean cake is a perfectly safe food when used with discretion, but notwithstanding its high analysis ordinary soy bean cake at £6 15*s.* per ton seems to be a dearer feeding-stuff than good linseed cake at £9; and (2) that the poorer the soy bean cake is in oil the better are the results obtained; for the soy bean cake containing 6 per cent. of oil has given more profit than the cake with 8 per cent. of oil, and still more than the one with 11 per cent.; and when the increased cost of the richer cake is taken into consideration, the results are much in favour of the soy bean cake with least oil. It would seem that the quality of the oil of the soy bean is responsible for this result.

Effect of Soy Bean Cake on Cattle (*Field Expts. at Harper Adams Agric. Coll. and in Staffs and Salop, Report,* 1909).—Complaints were made by users of this cake that loss and damage had been caused to stock by its use. Consequently a trial was made at the College of the cake used by a farmer who attributed to it the death of a heifer. Two rather delicate two-year-old heifers were selected for the experiment, and supplied with as much green clover and water as they would take. In addition, one received $1\frac{1}{2}$ lb. Bibby cake and 1 lb. Soy cake. The Soy cake was increased in quantity $\frac{1}{2}$ lb. per day until 7 lb. per day was being given, which was as much as the animal would clear up. At this stage the Bibby cake was stopped, and the 7 lb. per day of Soy cake continued until the end of the trial. The other heifer received at first no Soy cake, but 3 lb. of Bibby cake, which was increased by $\frac{1}{2}$ lb. per day up to $6\frac{1}{2}$ lb. When this point had been reached, a sudden and complete change was made. The Bibby cake was stopped and 7 lb. of Soy cake was given in its place. No difference was noticed at all in the animal or in the consistency of the dung. Both animals gained in weight during the trial. The contention that Soy cake may be harmful to stock if fed in any quantity, and if given suddenly, is not upheld by this trial, as purposely

delicate animals were selected, and the sudden change and large quantity given had no ill-effect.

Soy Bean Cake as a Food for Milch Cows (*Roy. Agric. Coll., Cirencester, Scientific Bull. No.* 1, 1909).—This experiment was carried out for four weeks, from April 12th to May 9th. Two lots of three cows each were selected from the College herd, care being taken that their age, period of lactation, and quantity of milk per day were as nearly equal as possible. They were turned out to grass on April 5th, and received the following concentrated food each per day:—Lot I., Soy bean cake 4 lb., bran 1 lb., ground oats 2 lb.; Lot II., decorticated cotton cake 4 lb., bran 1 lb., ground oats 2 lb. In addition all received 35 lb. pulped mangolds, 6–8 lb. chaff, and a small allowance of hay. The milk of each lot was weighed night and morning, tested for the percentage of butter-fat and cream, and churned three times a week. The conclusion from the trial was that the yield of milk seemed to be little affected by the kind of cake used. The percentage of butter-fat in the case of the bean cake remained almost constant; with the decorticated cotton cake the percentage had a tendency to fall. The butter produced by the bean cake was of a soft, oily nature, and churned quickly, but it yielded well (1 lb. of butter from 26·12 lb. of milk). The butter produced by the decorticated cotton cake, on the other hand, was hard, and took a longer time to churn; the yield, however, was not so good as from the bean cake (1 lb. of butter from 27·42 lb. of milk). From this it seemed that the Soy bean cake would be the better food for winter feeding, especially at the then prevailing prices of each. The butter from the bean cake was of a decidedly paler colour, and somewhat inferior flavour as compared with that from the cotton cake. No difference as to the laxative effect or otherwise of the two cakes was noticeable in the cows.

Effect of Soy Bean Cake on Cattle (*Board of Agriculture and Fisheries*).—Soy bean cake, some of which had been held responsible by a farmer for the death of three heifers, was fed to a Jersey heifer in the following quantities:—First week, 3 lb. of the broken cake daily; second week, 6 lb. daily; third week, 10 lb. daily. No ill-effects were produced, and the improvement in the condition of the heifer was most marked. (The death of the three heifers referred to was found to be due to poisoning with arsenical sheep-dip paste.)

Feeding Dairy Cows with Soy Cake (*Midland Agric. and Dairy Coll., Reports on Expts. with Crops and Stock*, 1909–10).—Soy bean cake was compared with linseed cake in a mixed ration. Two lots of four cows were fed from January 31st to March 26th, and the following ration was given:—56 lb. mangolds, 7 lb. chopped straw, 2 lb. mixed meal, 3 lb. undecorticated cotton cake, and either 3 lb. Soy cake or 3 lb. linseed cake. The Soy cake was bought at £7 5*s*. per ton, and the linseed cake at £8 17*s*. 6*d*. per ton. In order to lessen irregularities, one lot of cows was fed for the first month on Soy cake and changed to linseed cake for the second month, while the other lot was given linseed cake for the first month, and Soy cake for the second. In this way all the cows had Soy cake for four weeks and linseed cake for four weeks. The total yield of milk from eight cows getting Soy cake for four weeks was 4,964 lb., while from the same cows on linseed cake it was 4,848½ lb. The cows increased

in weight while on Soy cake by 2 qr. 9 lb., and while on linseed cake by 1 cwt. 1 qr. 6 lb. There was thus a gain of 115½ lb. in milk from the Soy cake, but an increase of body weight of 2 qr. 25 lb. from the linseed cake. This result was, however, partly due to one cow drying off, so that she gave very little milk in the second month when on linseed cake, while naturally her live weight increase was high. Some of the cream was churned on three occasions. In all three tests it was found that the Soy cake gave the firmer butter, but a lower yield of butter. The conclusion is drawn that both linseed and Soy cakes gave satisfactory results, and, without taking into account the quality of the milk, the value of the two cakes appeared to be about in accordance with their prices.

Soy Bean Cake for Fattening Sheep (*Univ. Coll. of N. Wales, Bangor, Bull.* 11, 1909).—Thirty Welsh mountain lambs were divided into two lots and fed from January 10th to March 10th. The food given consisted of as much swedes and hay as they would eat, and also ¼ lb. per head of crushed oats, and ¼ lb. of either Soy bean cake or linseed cake. The amount of swedes and hay consumed was practically the same in each case, 7 lb. of swedes and ¾ lb. of long hay per head per day. The results show that in the two months the lot fed on Soy bean cake made a gain of 125 lb. in live weight, while those fed on linseed cake made a gain of 154 lb., a difference of 29 lb. in favour of linseed cake. The amount of cake eaten was 221 lb. in each case, the Soy bean cake, at £7 per ton, costing 13*s.* 10*d.*, and the linseed cake, at £9 12*s.* 6*d.* per ton, costing 19*s.* It is considered that the Soy bean cake showed itself to be a good feeding-stuff, and, as its manurial value is higher than that of linseed cake, that the prices paid for the two most probably represent fairly accurately their relative values.

Molascuit as a Food for Milch Cows (*Roy. Agric. Coll., Cirencester, Scientific Bull., No.* 1, 1909).—Two lots of three cows from the College herd, as nearly equal as possible in age, period of lactation, and quantity of milk per day, were fed for three weeks, Molascuit meal being compared with ground oats. The food given per day was 40 lb. pulped mangolds, 8 lb chaff, 16 lb. hay, 2 lb. decorticated cotton cake, 2 lb. Soy bean cake, and, to one lot, 2 lb. of Molascuit meal, to the other 2 lb. of ground oats. In the second and third weeks the decorticated cotton cake and Soy bean cake were reduced to 1½ lb. each, and the Molascuit meal and ground oats increased to 3 lb. The yield of milk seemed to be little affected by the kind of food used, and the percentage of butter-fat in each case remained almost constant. There was practically no difference in the flavour of the butter produced, and no difference was noticed in the laxative effect or otherwise on the cows.

Effect of Keeping Dairy Cows Out at Night in Winter (*Field Expts. at Harper Adams Agric. Coll., and in Staffs and Salop, Rept.,* 1909).—The regular practice in Shropshire is to bring all milking cows into the house at night about the end of October, a proceeding which necessarily entails extra labour in attendance, and also extra hay in the racks and straw for bedding. In this experiment the effect was tried of leaving the cows out at night for a month or five weeks longer, and in one year eight weeks longer, till December 31st. It was carried

on for four years, 1901–4. Two lots of five cows, as nearly alike as possible in weight and length of time in milk, were selected, and were treated in exactly the same manner, except that one lot was kept in at night after milking, and the other lot turned out. The former lot were given about 8 lb. of hay each in the racks at night. The average results in four years with 10 cows each year are as follows (the second four weeks of the experiment in 1904 are omitted, as owing to cows calved in February drying off they are not comparable. The results were, however, similar) :—

	Outdoors.	Indoors.
	lb.	lb.
Yield of milk per cow per week during the period before the experiment	124	123
Yield during the experiment	119	112
Increase in percentage of butter fat during	Per cent.	Per cent.
the experiment	0·51	0·35
Increase in live-weight per cow per week	lb.	lb.
during the experiment...	1	—

These results are decidedly in favour of leaving the animals out at night, as regards milk yield, while the treatment did not appear to affect their weight. Observations were made on the animals on very cold nights, and they were found lying down close to the homestead. No shelters were available for them, and they did not appear to seek shelter from the hedges.

Sheep Breeding and Feeding (*Cumberland and Westmorland Farm School, Newton Rigg, 13th Ann. Rept.*, 1908–9).—The first trial dealt with crossing for fat lambs. Lonk-Wensleydale ewes were compared with the local grey-faced ewe (Scots black-face—Border-Leicester). Half the ewes of both kinds were given to a Border-Leicester ram, and half to an Oxford Down. The Lonk-Wensleydale proved as prolific as any cross-bred ewe that has been tried at Newton Rigg, but was not as good a milker as the grey-faced ewe, and the lambs, like those from other ewes of a Wensleydale cross, required a comparatively long time to get ready for the fat market, being better growers than fatteners. With regard to the different rams, the lambs sired by the Oxford Down made heavier weights at the same age than those by the Border-Leicester; on the other hand, the latter made rather a better price per pound on account of fattening more easily for an earlier market.

In the feeding trial 27 Herdwick hoggs were bought at the end of October, and wintered on grass with a rack of hay and occasional swede tops. From the beginning of January cut swedes were fed daily in troughs, and from the beginning of February ½ lb. of linseed cake and ½ lb. oats daily to every three hoggs. They were clipped in May, and sold fat at the end of June. The following figures show the return realised :—

Selling Price	£37	16	0			
Wool—100 lb. at 4d. ...	1	13	4			
				£39	9	4
Cost Price	12	3	0			
Cake and Corn consumed	0	12	0			
				12	15	0
Gross Profit				£26	14	4

This leaves nearly £1 gross profit per head, or 6¾*d.* a week each for grazing and hay.

Breeding of Sheep (*Univ. Coll. of N. Wales, Bangor, Bull.* 7, 1909).—Breeding experiments with Welsh mountain ewes for the production of fat lambs have been carried out for the last ten years. In 1909 four lots of twenty-five ewes were mated with Southdown, Dorset Horned, Ryeland, and Kerry Hill rams. The lambs were sold to the butcher as they became fat. Particulars are given of the number of lambs of each cross dropped, the dates at which they were sold fat, and their live weights at that time. No very marked differences are shown. It is considered that in 1909 the Southdown cross were the best in point of quality and fatness. The lambs of this cross have not been at the top each year, but they have always given good results. Whatever the season few have failed to get fat. Other crosses in some circumstances reach higher weights, but for those who desire to have fat lambs of the highest quality this cross would appear to give all that is desired.

The Dorset Horned cross has done well on each of the occasions on which it has been tried at Madryn. The lambs are larger in frame than those of the Southdown cross, but do not equal them in quality. On really good land they would probably show to greater advantage than at Madryn. The Ryeland cross are perhaps better suited for slaughtering in the late summer or early autumn than as fat lambs. They have good frames, and would probably do better than some of the other crosses for keeping till the following spring. The Kerry Hill cross did well, but were not so good as in the previous year.

FOREIGN EXPERIMENTS.

Manuring of Apple Orchards (*Pennsylvania Agric. Expt. Stn., Bull. No.* 100—*The Fertilisation of Apple Orchards*).—In this bulletin an account is given of an extensive series of experiments on fertilisers for apple orchards in Pennslyvania. The trials were made on eleven orchards, comprising ten soil types and twelve varieties of apples. The aggregate experimental area was 91 acres, and the experiments extended over three years.

The authors of the bulletin state that no recommendation will fit all cases, but where a fertiliser is needed good results may be expected from a dressing of artificial manure containing 30 lb. nitrogen, 60 to 75 lb. phosphoric acid, and 50 lb. potash per acre. Young trees require smaller, old trees heavier dressings. Nitrate of soda should be given after the blossoms fall; other manures during winter or spring. Nitrogen may also be profitably supplied by growing and ploughing in some leguminous crop, such as clover. Stress is laid on the need for maintaining a surface mulch, either by cultivation, or by littering with some loose material, such as old straw. It is stated that nitrogenous manures give an increased yield and growth at a sacrifice of colour. The Woburn experiments, 1894–1908, are discussed. In the authors' opinion, the negative results obtained are due to the fact that "some orchards are limited" by factors other than fertilisers.

It is suggested in the bulletin that the quantities of plant food recommended may be made up as follows, per acre:—100 lb. nitrate

of soda ($15\frac{1}{2}$ per cent. nitrogen), 100 lb. dried blood ($12\frac{1}{2}$ per cent. nitrogen), 250–300 lb. steamed bone meal (24 per cent. phosphoric acid), and 100 lb. sulphate of potash (50 per cent. potash); or, alternatively, 100 lb. nitrate of soda, 120 lb. dried blood, 400–500 lb. superphosphate (15 per cent. phosphoric acid), and 100 lb. sulphate of potash.

These quantities would be for bearing trees of medium age; for younger trees they may often be profitably reduced by a third or more, and for older trees they should be increased. These dressings are suggested as a first treatment for average conditions, to be varied according to results. Annual applications of the artificials, with stable manure at the rate of ten tons per acre every third or fourth year, are thought likely to give the best results, but it must be remembered that the effect of the first dressing may not be apparent till the second year or even later.

Everyone who cultivates fruit for a living should set aside a small section of the orchard for experimental purposes, and endeavour to find out by actual trial the methods of manuring, pruning, spraying, and general management which are most suitable to his special conditions.

Occurrence of Codling Moth in Walnuts ("*On the Nut-feeding Habits of the Codling Moth,*" *U.S. Dept. of Agric., Bureau of Entomology, Bull. No.* 80, *Part v.*).—The Codling Moth (*Carpocapsa pomonella*) is usually a serious enemy to apples and pears, but it is reported in this bulletin that a somewhat extensive infestation of walnuts has occurred in California. So far all observations indicate that only the later broods of larvæ attack the walnuts, as no walnuts could be found showing early injury, that is, before the shell hardened. Assuming that the larval life in walnuts is the same in length as in apples and pears, the earliest date of infestation would be late August or early September. The Bartlett pear, which is grown in the district where the infestation has occurred, is picked prior to this time, and before all the second brood of moths have developed. It is probable that these late-appearing individuals seek the walnut as the only remaining plant suitable for egg-laying.

OFFICIAL NOTICES AND CIRCULARS.

The Board of Agriculture and Fisheries have recently issued the following memorandum relating to the granting of licences for the removal of gooseberry bushes affected with American Gooseberry Mildew :—

Licences for the Removal of Gooseberry Bushes affected with American Gooseberry Mildew.

In consequence of the spread of American Gooseberry Mildew over a large part of Great Britain during 1910 the Board of Agriculture and Fisheries have found it necessary to schedule as diseased a very large number of gardens, among which several important nurseries are included, and to prohibit the movement of gooseberry and currant bushes from them except under certain conditions.

In order, however, to avoid as far as possible the injury to trade which such restrictions may cause, the Board are prepared to sanction

the removal of bushes from scheduled premises under the following conditions: —

1. A licence (Form A.) will be issued on the application of any scheduled grower who can satisfy the Board that all the diseased bushes on his premises have been burnt.

On the issue of such a licence the grower will be permitted to sell his bushes without restriction.

2. A licence (Form B.) will be issued on the application of any scheduled grower who can satisfy the Board that all visible disease on the diseased bushes in his garden has been cut off and burnt, and that the precautions which he has taken against the spread of disease are such as to reduce the risk to a minimum.

On the issue of such a licence the grower will be permitted to sell his bushes without other restrictions than the following:—(*a*) The bushes must while being moved bear a label with a distinctive number on which is written or printed the words, "Bushes moved under a licence (Form B.) of the Board of Agriculture and Fisheries, No. ——." (The figure inserted here would appear on the licence.) The label must be signed by the occupier of the premises or his agent. (*b*) The grower must cause the removal of each consignment of bushes to be entered in a register kept by him for the purpose and open to inspection by any Inspector or other officer of the Board or of the Local Authority. The entry must show the date of removal, the name and address of the purchaser, the quarter or bed from which the bushes were lifted, the number of bushes moved, the place to which they are sent, and the distinctive number of the label attached to the parcel or consignment.

Purchasers should be asked to keep this label for exhibition to the Inspector if called for at any time.

3. A licence (Form C.) will be issued on the application of any scheduled grower who wishes to move his bushes, or cuttings from them, from scheduled premises to another part of his own premises, and who can satisfy the Board that the bushes have been duly pruned. Such licences are also issued to fruit growers who wish to sell a few bushes, but not to trade in bushes extensively.

The conditions of this licence require that the bushes shall be moved from premises specified in the licence to other premises also specified in the licence and before a specified date. Applications for such a licence must be made on a special form which will be sent on application to the Secretary of the Board of Agriculture and Fisheries.

Special licences for the removal for exportation of bushes from scheduled premises will also be issued. The number of bushes it is proposed to move, the approximate date of removal, the quarter or bed from which they are to be lifted, the country to which they are to be sent, and the name and address of the person who will undertake that the bushes shall be duly exported must be sent. The only conditions imposed are that the bushes shall not be brought in contact with other bushes in this country, and that they will be exported before the date specified in the licence.

The regulations as to licences under Form B. do not apply to premises within the districts to which the Wisbech, Spalding, Evesham, Swanley, Maidstone, and Sandwich District Orders apply. Only A.,

C., and export licences can be issued in these cases. The conditions governing the issue of A. and C. licences, which are in nearly all respects the same as those described above, are set out in the respective Orders.

Sellers of gooseberry bushes are requested to advise their customers to examine their purchases very carefully from whatever source they are obtained, to cleanse them of all earth, and to cut off and burn the tips before planting them, in order to avoid all risk of possible infection.

Applications for licences must be made in writing to the Secretary of the Board of Agriculture and Fisheries, 4 Whitehall Place, London, S.W., and reference should be made to the garden for which a licence is required; the name or description as written on the notice Form A. declaring the premises infected must be quoted in every case.

T. H. ELLIOTT,
Secretary.

Bulletins of the International Institute of Agriculture.

The International Agricultural Institute has recently published the first issue of its monthly *Bulletin of the Bureau of Economic and Social Intelligence.* This publication, of which an English edition has been issued, consists of 450 pages, and deals, as will the two following numbers, with agricultural co-operation and organisation in the States adhering to the Institute. In the fourth issue of the Bulletin it is hoped to publish studies on agricultural insurance in all its forms, and later non-co-operative agricultural credit will be dealt with.

The present number contains an account of the position of agricultural co-operation in seven countries, namely:—Germany, Austria, Italy, Denmark, United States, Great Britain and Ireland, and Japan. In the case of the three first-mentioned countries the account given is complete, whilst in the case of the remaining countries the accounts will be completed in the two succeeding issues. The arrangement of the Bulletin is admirable, and deserves special attention. While each country is considered separately, the information given is arranged on a uniform plan, making comparison simple. The account of each country is divided into five parts. The first part contains certain introductory information of a general character which enables the reader to understand the relation of the general situation of the country to the specific conditions of its agricultural organisations. The second part gives short monographs dealing with the different forms of co-operative organisation in the country. In the case of Germany, for instance, this part contains an historical and statistical sketch of the present state of agricultural co-operation in Germany and a brief study of the co-operative land credit societies in that country. The third part is devoted to various difficulties and problems which have arisen in the country under consideration. The fourth part contains a record of recent events, and in this part an account of new legislative or administrative measures adopted by the various States in favour of agricultural organisations is given, together with any resolutions meriting attention which have been adopted by the more important societies. In this part also, a bibliography is given of the

principal works recently published dealing with agricultural co-operation. The fifth part deals with those subjects which, although not strictly bearing on agricultural co-operation, are closely allied to it. For instance, the organisation of the markets for products such as chemical manures and seeds, or legislation with regard to small holdings, is included in this section.

Complete information with regard to this subject, not only in Continental countries, but also in Great Britain itself, has not up to now been easily accessible, so that this Bulletin, containing as it will do a concise account of agricultural co-operation in each of the principal countries of the world, should prove of great value to all persons interested in this important branch of agricultural development.

The Institute also issues a monthly Bulletin of Agricultural Statistics, which is published regularly on Saturdays about the 20th of each month. This Bulletin is chiefly devoted to reports on Crop Prospects, and a summary of the information contained in it is given regularly in this *Journal.*

The Institute has also in hand a Bulletin of Agricultural Intelligence and Diseases of Plants, the first number of which will be issued shortly.

Copies of these Bulletins are supplied free to societies, institutions, newspapers, and persons holding official positions, but up to the present no arrangement has been decided on as regards their sale to the general public. Persons wishing to examine them can, however, do so at the Library of the Board of Agriculture, 8 Whitehall Place, S.W., or they can be borrowed on the usual terms applicable to the loan of books.

The Institute has also published two volumes which are complete in themselves, viz. :— (1) The organisation of agricultural statistical services in different countries; and (2) statistics of cultivated areas and of vegetable and animal production in the countries adhering to the Institute.

Crown Gall.—The illustration of "Crown Gall" which appeared in the *Journal* for November, 1910, was wrongly described as "Crown Gall" of the rose. The gall illustrated was that of *Chrysanthemum frutescens*, which is very similar in appearance to the "Crown Gall" of the rose.

IMPORTATION REGULATIONS.

Free Importation of Live Stock into Grenada.—The Board of Trade have received from the Colonial Secretary at Grenada a copy of an Order-in-Council, which was approved by the Legislative Council on October 5th last, and which amends Ordinance No. 1 of 1905 by providing for the free importation into the Colony of live stock, viz. :— "Live stock, in cases where the Governor-in-Council is satisfied upon documentary or other evidence that the importation of any animal or animals is likely to improve the breed of such animal already in the Colony."

Importation of Animals of the Equine Species into Belgium.—A Belgian Royal Decree, dated August 4th, 1910, provides that animals

of the equine species, intended to be slaughtered for food, are not to be imported into Belgium unless they are recognised as free from such maladies and infirmities as may be specified by the Ministry of Agriculture. Animals refused admission may either be re-exported or else slaughtered and the carcasses destroyed without the payment of any indemnity.

A Ministerial decree of the same date declares that among the infirmities so defined are included (*a*) serious maladies; (*b*) maladies which without being serious are of a repugnant character: mange, extensive herpes, chronic thick leg, canker (crapaud), grease, purulent arthritis, fistulous withers, abscess, phlegmon, or extensive tumour.

Importation of Live Stock into Mexico.—The Board have received through the Foreign Office a copy of the regulations relative to the importation of live stock into Mexico. It is provided in the Sanitary Code of Mexico that cattle imported into the country must be accompanied by a certificate from a duly authorised veterinary surgeon, which must be countersigned by the Mexican Consul resident in the country of origin, stating that the animals are not affected with any contagious or infectious disease. On entry into the country, provision is made by the Mexican Board of Health for their further examination by a veterinary surgeon, and their importation is prohibited if the examination should clearly prove that they are suffering from infectious or contagious disease. If they are suspected of suffering from any such disease, the animals must be placed in quarantine. An order of the Mexican Ministry of the Interior, dated February 18th, 1910, prescribes that all cattle must be accompanied by a certificate of a legally authorised veterinary surgeon in the country of origin, countersigned by the Mexican Consul, showing that the animal imported has been subjected to the tuberculin test at least fifteeen days prior to its importation through the Custom House.

Under the existing customs' tariff live stock are exempt from duty, with the exception of pigs and castrated horses.

MISCELLANEOUS NOTES.

Agricultural Exhibitions Abroad.

Horticultural and other Shows at the International Exhibition at Turin.—In connection with the International Exhibition at Turin, of which particulars were given in this *Journal*, July, 1910, p. 327, a permanent Horticultural Exhibition will be held from April to November, 1911, and also three Temporary Shows. The permanent section forms part of the General Exhibition, and includes matters relating to the cultivation of fruits, vegetables, and flowers; garden implements and tools; and teaching and appliances for teaching.

The three temporary Flower and Fruit Shows will be held as follows:—Spring Show, May 15th to 25th, 1911; Summer Show, September 16th to 24th, 1911; and Autumn Show, October 25th to November 4th, 1911. Copies of the regulations and schedules relating to these shows may be obtained from the Secretary to the Horticulture Committee, 21 St. James's Square, S.W.

Shows will also be held of the following, but the dates have not

yet been fixed in all cases:—Poultry and Rabbits, May 4th to 7th; Dogs (probably in the latter part of May); Cattle, Sheep, Pigs, and Horses (in September).

Exhibition of Hybrid Animals at the Odessa Exhibition.—According to a report by H.M. Acting Consul-General at Odessa, some exceptionally fine specimens of ordinary domestic and hybrid stock were exhibited at the Odessa Exhibition of 1910, by the owner of a large estate in the Government of Taurida. These exhibits excited a great deal of interest and curiosity, especially as this new departure may be of importance to agriculture in the future.

Four Zebridas, the result of cross-breeding between a zebra and a mare, were shown, and are described as remarkable animals in many respects, exceedingly handsome, having every appearance of great strength, and possessing great resistance to fatigue. They are also hardy and not difficult to feed. It is possible that similar experiments might produce equally good results in some of the British Colonies, where horses of ordinary breed are unable to stand the climatic conditions, or at any rate to furnish a reasonable amount of work.

A specimen of the wild horse also created a great deal of interest, chiefly owing to its extreme rarity. The animal is about the size of a small polo pony, and very thick-set, with a comparatively big head and small ears. It is not stated if any experiments have been made by crossing it with an ordinary brood mare, but the result would be of considerable interest.

Another hybrid exhibited was the Zubrida, a hybrid animal resulting from the crossing of a Russian Zubr, or bison, with the ordinary domestic cow. The Zubrida is a strong, powerful animal, eminently suitable for traction purposes, and, unlike most hybrids, is able to reproduce its species. The aim of the breeder in this case is said to be to produce animals highly resistant to climatic influences.

A similar experiment, with equally good results, has been made to cross the American buffalo with the domestic cow. As the former animal is yearly becoming more rare, it is hoped by this means to save the species by instilling new blood. There would appear to be no reason why such an attempt should not be successful, in the sense of producing an animal possessing one-eighth or less of the blood of ordinary domestic cattle, and in all essential points resembling the pure buffalo.

The horses, some of which were sent to the Exhibition from the Government stud in the Kherson Government, showed the great and increasing care which is now being bestowed on the breeding of horses in South Russia.

International Agricultural Congress, Madrid, 1911.—The Board of Agriculture and Fisheries are informed that the 9th International Agricultural Congress will be held at Madrid from May 1st to 6th, 1911, under the distinguished patronage of his Majesty the King of Spain. In accordance with the decision of the last Congress held at Vienna in 1907 the Congress at Madrid will be divided into eight sections, and the subjects to be discussed will include the organisation of co-operation and agricultural credit, reafforestation, diseases of fruit trees, animal nutrition, and the application of new manures.

Societies or private persons can participate in the Congress, the

subscription for each person or representative being 20 pesetas (or approximately 16*s.*). Applications for admission, which must be made before March 15th next, should be addressed to the Secretaries of the Organising Committee of the Congress at the Offices of the Society of Spanish Agriculturists, 12 Campoamor, Madrid.

Notes on Agriculture Abroad.

Cattle Raising in Panama.—Cattle raising is the principal industry of the country, and the animals are all sent to Panama to be killed for consumption. It is often recommended that pedigree animals from abroad should be introduced to improve the local stock, and the improvement in Argentine stock by the introduction of British breeds is pointed to, but few cattle-raisers are affluent or far-sighted enough to follow this course. In 1906 the sum of £2,000 was voted by the National Assembly for the introduction of foreign pedigree stock. The stock bought was sold at public auction and the money used to procure more. At present about £800 is in hand for the purpose. In connection with the proposed agricultural experimental station, it has been suggested that the Government should import high-class animals from abroad and allow stock-owners their services against a nominal fee. An agricultural fair, the first to be held in the country, will be held in 1911 at Anton, a town with a population of about 5,500. (*Foreign Office Reports, Annual Series, No.* 4571.)

Opening for the Importation of Manures, &c., into Finland.—H.M. Consul at Helsingfors (Mr. C. J. Cooke) reports that a firm at that place desire to obtain the representation of British firms exporting artificial manures, all kinds of fodder, &c. H.M. Consul remarks that the present is the best time of the year for selling such goods. The name of the firm may be obtained by British firms on application to the Commercial Intelligence Branch of the Board of Trade, 73 Basinghall Street, London, E.C. Any further communications regarding the inquiry should be addressed to the British Consulate, Helsingfors. (*Board of Trade Journal,* November 17th, 1910.)

Possibilities of Wheat Production in Manchuria.—H.M. Acting Commercial Attaché at Peking (Mr. H. H. Fox) has forwarded a précis of an article on the subject of wheat growing in Manchuria, by Mr. E. C. Parker, Chief of the Bureau of Agriculture at Mukden, from which the following information is extracted:—

The area of Manchuria is approximately 360,000 square miles, with an estimated population of from 10 to 12 millions. The present annual production of wheat is about 10 million bushels, which might be increased, Mr. Parker thinks, to from 300 to 400 million bushels, even with the primitive methods of native cultivation.

The soil and climate are as favourable for wheat production as in the valley of the Mississippi. The native wheats are chiefly of the bearded and smooth chaff type; but Fife, Blue Stem, and Canadian Club types are also seen. Though the region is naturally favourable for wheat production, the crop has never been extensively grown, chiefly because the yield of wheat is less per unit of land than that of millet, sorghum, or maize, and these foods are better adapted to the standard of life and the purchasing power of the Chinese family. Of late years, however, there has been a noticeable growth in the consump-

tion of wheat among the Chinese throughout China, and in Manchuria in particular a strong demand for wheat flour has arisen since the Russo-Japanese war. At first this demand was supplied chiefly by the United States of America; but in 1909, on account of the high price of American flour owing to the depreciation of silver and of the increased production of the Shanghai and Manchurian mills, the import practically ceased.

Flour is produced by steam roller mills at Harbin, Changchun, Hailin, and Shuangchengpu, under Russian management, at Ninguta, Aseho, and Kirin, under Chinese management, and at Tiehling under Japanese management. In 1909, according to steamship and railway statistics, 5,400,000 bushels of wheat passed into Harbin, of which 3,600,000 bushels were milled locally, and 1,800,000 bushels were exported by the Sungari River to Siberia.

The milling of wheat in Manchuria is increasing rapidly, and Mr. Parker considers that, with cheap wheat, cheap labour, and low transportation charges, the Manchurian mills, with the steam mills at Shanghai, must inevitably capture the flour trade of the Far East.

In January, 1910, No. 1 wheat was worth at the mills 84 cents U.S. gold (3*s.* 6*d.*) per bushel, and at harvest time wheat was selling for 66 cents gold (2*s.* 9*d.*) per bushel. The highest and lowest prices recorded during the past three years have been 56 cents gold (2*s.* 4*d.*) and 84 cents gold (3*s.* 6*d.*) per bushel. In Mukden "second patent" flour from the Japanese Tiehling mills was sold in August last at 3·93 dollars gold (16*s.* 4½*d.*) per barrel of 196 lb., and flour from the Russian mills at Harbin of similar quality at 4·08 dollars (17*s.*) per barrel. (*Board of Trade Journal*, November 3rd, 1909.)

The Employment of Women in Agricultural Pursuits in Bavaria.—An influential meeting at Munich in the spring of 1910 expressed the wish that professional education for young females living in rural districts should be provided for, and that agricultural schools, viz., continuation schools, special, and winter schools, be established. As a result of the census in 1907 it was shown that Bavarian agriculture is in a high degree dependent on the work of women, as the number of male hands is constantly decreasing. Over 873,000 women against not quite 825,000 men are employed; the number of the non-independent women amounts to 63·3 per cent. of the total of non-independent rural labourers. Therefore there seems to be a pressing need for both experienced female agriculturists and female teachers, for the instruction as well as useful assistance of agricultural hands, especially with a view of making women efficient in the adaptation of the modern important and profitable ways of general farming, viz., breeding of poultry, fruit and vegetable growing, dairy work, &c. The Bavarian Home Office on January 23rd, 1910, issued a notice instructing the district councils to aid and assist generally the itinerant lecturers sent about by ladies' associations. (*Foreign Office Reports, Annual Series, No.* 4565.)

Live Stock Insurance in Bavaria.—In his Report to the Foreign Office (*Annual Series,* No. 4565), Mr. Consul Ehrenbacher gives particulars as to the operations of the National Live Stock Insurance Society in 1909, and also of the Government House Insurance Institute.

Agriculture in Egypt.—A Report by Mr. W. H. Cadman, B.Sc., F.C.S., on agriculture in Egypt in 1909, is included in *Foreign Office Report, Annual Series, No.* 4554. Mr. Cadman refers to the steps which are being taken by the Egyptian Government and the Khedivial Agricultural Society as regards scientific investigation, the development of existing agricultural industries, and the introduction of machinery.

Agriculture in Germany.—The Report to the Foreign Office (*Annual Series, No.* 4570) on the Trade and Commerce of the Consular District of Frankfort for 1909–10, by Consul-General Sir Francis Oppenheimer, contains a review of the agricultural conditions prevailing in Germany during the year. Statistics are given showing the price of meat at various markets, with particulars of the consumption and importation. In the same way the conditions in the grain markets and in the milling trade are discussed in some detail.

Wool Production in Argentina.—The *Nachrichten für Handel und Industrie* (Berlin) of November 1st states, on the authority of the German Consul-General at Buenos Aires, that the production of wool in Argentina for the twelve months ending September 30th last is estimated at 186,800 tons, being 20 per cent. less than that of the preceding twelve months. This diminution is accounted for by the epidemic among the sheep, and the unusually light average weight of the fleece. The principal markets for Argentine wool in 1909 in order of importance were France, Germany, Belgium, and the United Kingdom. (*Board of Trade Journal,* November 17th, 1910.)

Cattle and Horse Breeding in Brazil.—Brazilian stock raisers are awaking to the necessity of improving their national breed of cattle, which is both deficient in size and in the production of milk. In the districts served by the railways, a fair number of pedigree stock has been imported from Europe and the United States, the principal object being milk, and for this purpose British, Dutch, and Swiss cattle have been imported. For the farther interior of the Republic, where beef production is the main industry, a great many Indian animals have been introduced, and the crossing of these with the national breeds has resulted in a considerable increase in the weight of the product.

Redwater, or Texas fever, is the deadly enemy of imported European cattle, the percentage of deaths being exceedingly high, so that it is little to be wondered at that this importation has not developed to the same extent that it has in Argentina. The Indian cattle are immune to this disease, hence the reason for their continued importation. Latterly a few head of cattle, descendants of British sires, have been imported from Uruguay, from districts where Texas fever is prevalent, and these animals have proved to be immune to the scourge. Should a remedy be found for Texas fever, there will be a great development in the importation of British pedigree stock.

Stock raising is a very profitable business in many States, owing to the immense excellent natural pastures, the complete absence of prolonged droughts, and an ever-increasing demand for fresh beef, which is rapidly supplanting the jerked beef imported in large quantities from the River Plate.

A great stimulus has been given to the much neglected industry

of horsebreeding by the nomination of military officers to journey through the interior for the purchase of suitable remounts for the army. The national animal is very small, though wiry, and various breeds are recommended for its improvement, such as the Shire, Percheron, Hackney, and Arab. The Percheron has been imported to a fair extent, but attention now appears to be turning to the Arab.

Mule breeding is a profitable industry, and some very excellent ones are bred for riding purposes, whilst there is always a market in Minas for pack mules at slightly lower prices, but still profitable to the breeder. (*F.O. Repts., Annual Series, No.* 4575).

Consumption of Fertilisers in Sweden.—There are considerable imports of artificial manures into Sweden, and it is possible that the demand for fertilisers may extend in view of the increasing activity which is at present being manifested in Swedish agriculture. The possibility of increased imports is of some interest to British exporters, for though Sweden is mainly dependent upon Germany for fertilisers, a certain amount is furnished by the United Kingdom. The most important items are basic slag and superphosphate, of which 11,668 tons and 3,808 tons respectively were exported to Sweden in 1908. The total imports into Sweden in 1908 of basic slag and raw phosphate were approximately 23,607 tons and 95,986 tons.

The Swedish trade journal (*Affärsvärlden*) of September 15th, in an article on the subject of the importation of manures, a copy of which has been forwarded to the Board by H.M. Consul at Stockholm (Mr. Villiers), urges the need for increasing the country's own production of fertilisers. It is stated that Sweden could produce enough phosphate and Thomas slag to supply the agricultural need for some time to come, and possesses in her waterfalls the means of obtaining nitrogen from the air, *i.e.*, by the manufacture of nitrate of lime and similar products. As regards potash, it is entirely dependent on Germany.

Decline in Wool Production in Russia.—The British Acting Consul-General at Odessa (Mr. H. E. Dickie) has furnished the following particulars relative to the decline in the production of wool in European Russia :—

The gradual transfer of immense tracts of pasture land to peasant farmers and their division into small holdings, a process greatly assisted by the advances made by the Peasants' Bank, has had the effect of steadily diminishing the number of sheep in European Russia, a result which any possible increase of the flocks in Siberia can hardly counterbalance. Another consequence of this development has been the gradual falling off in the quantity of Russian produced wool, which is only to a small extent counteracted by the breeding of a breed of sheep which, taken individually, produces a larger quantity of wool than the usual breed. Some slight decrease in the quantity of wool produced is to be recorded for 1910, and if its dirty condition, as compared with the preceding year, is taken into consideration, this result will be all the more significant. The quality of the wool is considered to be fairly good, and there was not any appreciable loss of sheep during the winter of 1909-10. (*Board of Trade Journal,* September 15th, 1910.)

Consumption of Fertilisers in Poland.—A report by H.M. Consul

at Warsaw (Mr. C. Clive Bayley) on the trade of Poland (*F.O. Reports, Annual Series, No.* 4567) gives the following information respecting the consumption of fertilisers in Poland:—

The rise in the consumption of artificial manures in Poland was even greater in 1909 than in 1908, and, as the local works could not supply enough superphosphate, large quantities were imported from Germany. Basic slag, nitrate of soda, potassium salts, and sulphate of ammonia were also sold in very much larger quantities than during the previous year. The price of superphosphate was $2\frac{1}{2}d.$ per 1 per cent. of soluble phosphoric acid in 100 lb., delivered free at any station in Poland. In those districts situated near the frontier, German superphosphate was imported from Silesia and Posen, and could successfully compete with the local works owing to the easy means of supply by the numerous railway lines leading to the Russian frontier. The importation of British superphosphate, which would have to be of a high grade, is possible. The agricultural societies of Poland imported all basic slag from Belgium. Some of it was imported in a raw condition and ground in local mills. The price of basic slag was $1\frac{9}{10}d.$ per 1 per cent. of phosphoric acid soluble in citric acid in 100 lb. delivered free at any station in Poland. There is a large opening for the sale of British basic slag in Poland, provided it is of a high grade. Prices should be quoted c.i.f. Dantzig or Stettin, and credit must be given.

Potash Production in Germany.—A law has been passed, dated May 25th, to establish compulsorily a syndicate of all the works in Germany which are to be allowed to produce potash. The annual output of potash by this syndicate, and the quotas of the separate works belonging to it, are to be fixed by an authority appointed for the purpose. A scale of maximum prices is fixed for the home market, to remain in force until the end of 1913; after that date the maximum prices are to be fixed every five years by the Bundesrat. Except with the permission of the Bundesrat, prices for sales and deliveries abroad must not be lower than those fixed for the home market. The law is to remain in force until the end of 1925.—[*Board of Trade Journal,* August 4th, 1910.]

Use of Electric Power in Germany.—The report on the trade and commerce of Pomerania for the year 1909 (*F.O. Reports, Annual Series,* No. 4517) states that during the last few years electric central power stations have been erected in various parts of the province of Pomerania for supplying electric current to neighbouring towns, villages, estates, and farms.

These electric works are principally controlled by associations formed by landed proprietors, and sums have been voted by the Provincial Representative Chamber to assist these undertakings. Great value has been attached to supplying small farmers and artisans living in the country with electric light and power at a cheap rate. In many cases whole villages and small towns have been linked up with the central power stations.

The steady increase of wages and communal and social taxes has compelled farmers to work more economically. Should it therefore be possible to increase and develop these stations by means of cheap water power, the agricultural districts will no doubt greatly benefit thereby. The practical application of electricity has latterly made such

progress that in the next few years the cultivation and treatment of agricultural produce may be undertaken by this means. It is already possible to plough and thrash, to saw timber, to clean grain, and to cut turnips and beetroot by electrically-driven machines, and electricity is also extensively used in dairy farms, distilleries, factories, carpenters' shops, smithies, limestone factories, &c.

Census of Production.

Preliminary tables summarising the results of the returns received under the Census of Production Act are now being issued, and Part V. (Cd. 5397, price $5\frac{1}{2}d.$) contains figures relating to several industries dealing with agricultural products.

The following short statement, extracted from the report, shows for the United Kingdom as a whole the gross output, the cost of materials used, the amount paid for work given out to other firms, the "net output" and the persons employed, for the industries dealt with in the above publication :—

—	Gross Output. Selling Value or Value of Work Done. (1)	Materials Used. Cost. (2)	Work Given Out. Amount paid to Other Firms. (3)	Net Output. Excess of Column (1) over Columns (2) and (3). (4)	Persons Employed. Total. (5)
	£	£	£	£	
Grain-milling Factories	65,255,000	58,885,000	2,000	6,368,000	36,207
Bread and Biscuit Factories and Workshops.—Private Firms ...	38,840,000	27,250,000	—	11,590,000	110,168
Cocoa, Confectionery, and Fruit-Preserving Factories and Workshops	16,137,000	11,162,000	—	4,975,000	60,735
Factories and Workshops Manufacturing Farinaceous Preparations and Household Articles for Cleansing and Polishing (except Soap)	4,284,000	2,275,000	—	2,009,000	11,536
Cattle, Dog, and Poultry Food Factories and Workshops ...	1,385,000	1,082,000	—	303,000	1,879
Ice Factories	383,000	122,000	—	261,000	1,251
Sugar and Glucose Factories ...	12,315,000	9,026,000	—	3,289,000*	6,491
Brewing and Malting Factories and Workshops	67,110,000	25,774,000	196,000	41,140,000*	85,222
Spirit Distilling Factories	4,833,000	3,352,000	—	1,481,000	6,510
Spirit Compounding, Rectifying, and Methylating Factories and Workshops	4,011,000	3,613,000	—	398,000	1,121
Bottling Factories and Workshops	12,803,000	9,687,000	—	3,116,000	20,601
Aerated Waters, Cider, British-made Wines, Non-Alcoholic Beverages (Brewed), and Vinegar Factories and Workshops ...	6,060,000	2,476,000	—	3,584,000	28,653
Tobacco Factories and Workshops	23,799,000	17,988,000	—	5,811,000	37,456
Total	257,215,000	172,692,000	198,000	84,325,000	407,830

* In these cases the net output includes duty.

The following preliminary statement shows the estimated total produce and yield per acre, of the potato and root crops in Great Britain in the year 1910, with comparisons for 1909, and the average yield per acre of the ten years 1900–1909:—

Produce of Potato and Root Crops.

Crops.		Estimated Total Produce. 1910.	Estimated Total Produce. 1909.	Acreage. 1910.	Acreage. 1909.	Average Estimated Yield per Acre. 1910.	Average Estimated Yield per Acre. 1909.	Average of the Ten Years. 1900–1909.
		Tons.	Tons.	Acres.	Acres.	Tons.	Tons.	Tons.
Potatoes	England ...	2,467,179	2,643,109	376,834	405,529	6·55	6·52	5·90
	Wales ...	132,810	150,398	26,013	26,994	5·11	5·57	5·02
	Scotland ...	878,300	880,946	136,837	142,938	6·42	6·16	6·20
	Great Britain	3,478,289	3,674,453	539,684	575,461	6·45	6·39	5·93
Turnips and Swedes.	England ...	16,531,832	16,543,107	1,064,404	1,056,823	15·53	15·65	13·34
	Wales ...	1,000,613	959,767	58,494	58,219	17·11	16·49	15·42
	Scotland ...	8,081,008	7,620,676	442,447	440,506	18·26	17·30	16·06
	Great Britain	25,613,453	25,123,550	1,565,345	1,555,548	16·36	16·15	14·18
Mangold	England ...	9,105,471	9,316,314	429,457	442,910	21·20	21·03	20·04
	Wales ...	205,468	211,382	11,057	11,136	18·58	18·98	17·84
	Scotland ...	42,056	42,908	2,265	2,444	18·57	17·56	17·74
	Great Britain	9,352,995	9,570,604	442,779	456,490	21·12	20·97	19·97

NOTE.—The yield per acre of Potatoes was only slightly larger in 1910 than in 1909, but it is 10 cwt. above the decennial average. Owing, however, to the reduction of acreage, the total crop is smaller by 200,000 tons than last year, and nearly half-a-million tons less than in 1908. The yield per acre of Turnips and Swedes is the highest on record, and the total production larger than in any year since 1897. Mangolds have a higher yield per acre than in any year except 1902, while the total production of this crop is only a little below that of last year, which was the largest on record. The Preliminary Statement of the Produce and Yield per Acre of Hops for 1910 was issued on October 19th, and that of the Produce and Yield per Acre of the Corn, Pulse, and Hay Crops on November 8th.

The "Monthly Agricultural Report" issued by the Board of Agriculture and Fisheries on December 8th gives the following general summary of agricultural conditions in Great Britain:—

Report on Agricultural Conditions in Great Britain on December 1st.

The Crop Reporters of the Board, in reporting on the state of the crops and the agricultural conditions on December 1st, refer generally to the frosts and heavy rains which retarded autumn cultivation during November to a considerable extent, especially after the first week or two. Nevertheless, satisfac-

tory progress has been made, and as autumn work was well forward at the beginning of the month, farming operations are mostly well up-to-date. Reports on the appearance of the new wheat are somewhat variable; it is generally reported as healthy and vigorous, more especially that which was sown early, but that which was sown later has made but slow progress.

Inquiries were made of the Reporters as to the approximate proportion of the land intended for wheat already sown. From the reports received it would seem that about three-fourths of the total area intended for wheat had been planted by December 1st. The proportion varied in different districts: in the east, north, and south-east of England, some 80 to 85 per cent. had been sown, while in the west midlands and south-west the percentage was not more than about 70.

Comparing the present year with 1909, it would seem that by December 1st the area actually sown to wheat was about 10 per cent. greater than at the same date last year, the proportion being rather more in the north and east, and less in the west and south-west.

Mangolds had practically all been lifted before the end of the month. Good progress had been made with the lifting of such turnips and swedes as were not intended to be fed off, although in the north of Scotland the wet weather had greatly hindered this work. The quality and condition of the roots were generally good, there being very few reports of disease; but they are not infrequently described as small, especially the mangolds.

Labour is generally reported abundant, except in a few counties, including some in the north of Scotland, where there was a little scarcity of temporary labour for turnip lifting. On the other hand, Reporters in two or three districts of England mention that the supply of labour was greater than the demand.

In addition to the above general summary, the "Monthly Agricultural Report" contains local summaries giving further details regarding agricultural conditions in the different districts of Great Britain. For this purpose the counties of England are divided into eight groups; Scotland is given in two Divisions, while Wales is treated as one Division.

A copy of this Report can be obtained free on application to the Secretary, Board of Agriculture and Fisheries, 4 Whitehall Place, S.W.

Notes on the Weather in November.

The weather during the *first* week (October 30th to November 5th), though generally rough, squally, and frequently rainy, included several periods of clear or partially clear sky. Temperature was below the average in all districts, and even reached so low a point as 23° F. in England S.E. Rainfall was generally in excess of the normal, heavy falls being recorded over the whole of England, except in the Midland and north-eastern counties. In spite of this, most districts experienced an unusual amount of bright sunshine.

The conditions continued rough and unsettled during the *second* week, and snow and sleet were experienced at times in Scotland and the north of England. Temperature was again below the average, being classed as "deficient" in England E. and S.W., and "very deficient" elsewhere. There were frequent falls of rain in all districts, alternating with occasional fine intervals, and with the exception of "moderate" falls in England S.E. and S.W., the rainfall was "heavy" or "very heavy" over the whole of Great Britain. "Bright sunshine" continued "abundant" or "moderate" in all districts.

At the beginning of the *third* week, conditions were again unsettled, but later an improvement took place in the southern districts. Warmth was everywhere "deficient." Rainfall was "heavy" in all parts, except in the Midland counties, England S.W., and Scotland W., where it was "moderate"; and showers of sleet, snow, and hail occurred in the north and east.

During the *fourth* week the weather was fairer in the south and east than in the west and north, though in many places in the east and north-east of England it was dry nearly throughout the week, and was often fair to bright. Temperature continued below the average, and on one occasion 10° F. was even recorded at Balmoral. Rainfall was above the average in the Midland counties and England S.E. and S.W., there being a deficit elsewhere. The four weeks from October 30th to November 26th have been marked by abundant sunshine in several districts, those specially favoured in this respect being Scotland N. and E., and England N.E. and S.E.

Notes on Crop Prospects Abroad.

It was pointed out in the November issue of this *Journal* that the estimates made by the International Agricultural Institute at Rome of the area and production of the cereal crops in the Northern Hemisphere were likely to be subject to alteration when later returns were received. This has proved to be the case, largely in consequence of revised estimates having been made for Russia, with the result that the production of twenty-three countries in the Northern Hemisphere in 1910 is estimated at 99·97 per cent., or very nearly the same figure as that of 1909. In the case of the other crops the percentage is as follows:—Rye, 97·0; barley, 95·1; and oats, 94·1. The probable production therefore of these three crops is less than that of last year.

Particulars are now available for maize, which show that the production of twelve countries is likely to be 114·3 per cent of that of 1909.

The figures obtained, after having included all the official data available up to the date of the issue of the Bulletin, viz., about November 20th, are shown in the tables on the next page. The results, which only cover the principal countries in the Northern Hemisphere, may be summarised as follows:—

Wheat.—The area cultivated this year (222,191,000 acres) is 106·47 per cent. of last year's area (208,681,000 acres). The yield per acre

Country.	Area and Production in 1910 as compared with 1909.							
	Wheat.		Barley.		Oats.		Maize.	
	Area.	Production.	Area.	Production.	Area.	Production.	Area.	Production.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Prussia ...	108·2	105·5	94·6	80·9	99·3	87·4	—	—
Bulgaria ...	105·9	153·2	101·9	169·0	99·2	141·0	112·0	203·6
Denmark ...	98·1	106·7	99·7	91·5	99·2	90·3	—	—
Spain	100·7	95·4	95·8	93·5	102·3	84·6	97·4	103·3
France ...	98·9	73·5	101·6	95·6	99·7	93·7	—	—
United Kingdom	99·4	92·1	103·8	94·4	101·9	97·8	—	—
Hungary ...	108·6	157·6	102·5	87·4	101·6	84·1	100·9	119·9
Italy	101·0	80·7	99·1	86·6	100·0	65·8	99·0	103·1
Luxemburg ...	110·0	101·0	101·1	90·0	99·2	97·8	—	—
Norway ...	100·0	100·8	100·0	108·9	100·0	116·7	—	—
Netherlands ...	104·1	105·1	99·3	101·9	98·7	96·1	—	—
Roumania ...	115·3	188·2	100·0	143·4	92·2	109·5	93·5	146·9
Russia in Europe ...	109·8	97·9	106·0	99·1	103·3	87·7	96·1	154·0
Sweden ...	97·3	96·3	—	—	—	—	—	—
Switzerland ...	100·0	95·8	100·0	97·1	—	—	100·0	93·7
Canada ...	119·9	73·6	98·3	71·1	106·0	80·1	93·0	91·8
United States .	104·4	93·8	100·7	92·9	103·5	106·5	104·9	112·6
India	106·9	126·0	—	—	—	—	—	—
Japan	100·6	99·1	99·6	95·4	49·9	47·1	—	—
Russia in Asia .	100·4	133·2	97·6	132·2	93·6	131·4	116·1	200·0
Algeria ...	121·8	113·2	104·1	97·4	112·0	124·2	67·3	68·4
Tunis	111·2	85·7	104·4	72·5	103·3	98·7	100·0	94·9
Average ...	106·47	99·97	102·8	95·1	102·3	94·1	103·8	114·3

Country.	Wheat.		Barley.		Oats.		Maize.	
	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.
	1,000 acres.	1,000 cwts.	1,000 acres.	1,000 cwts.	1,000 acres.	1,000 cwts.	1,000 acres.	1,000 cwts.
Prussia ...	2,833	47,021	2,066	30,817	6,929	104,104	—	—
Bulgaria ...	2,721	26,310	610	6,750	482	3,768	1,681	20,781
Denmark ...	99	2,155	576	9,128	988	12,972	—	—
Spain ...	9,409	73,613	3,332	32,695	1,255	8,289	1,119	13,644
France ...	16,114	141,347	1,842	19,632	9,668	102,521	—	—
United Kingdom	1,856	31,165	1,896	29,049	4,093	60,834	—	—
Hungary ...	9,520	106,300	3,089	27,991	2,990	23,687	6,114	96,974
Italy	11,754	82,123	612	4,063	1,243	8,162	3,743	48,862
Luxemburg...	30	334	2	25	74	1,002	—	—
Norway ...	12	168	89	1,274	263	3,419	—	—
Netherlands .	132	2,316	70	1,449	345	5,815	—	—
Roumania ...	4,812	59,355	1,357	12,684	1,104	8,717	4,906	52,148
Russia in Europe ...	62,596	376,501	27,747	197,477	42,906	274,190	3,639	30,466
Sweden ...	222	3,566	—	—	—	—	—	—
Switzerland..	105	1,830	13	197	—	—	3	59
Canada ...	9,291	65,759	1,833	16,876	9,859	85,961	328	8,839
United States	48,767	370,486	7,054	67,754	34,367	313,168	114,038	1,560,250
India ...	27,828	191,254	—	—	—	—	—	—
Japan ...	1,115	11,809	3,221	39,239	54	682	—	—
Russia in Asia	8,439	51,290	693	5,034	4,425	29,175	21	258
Algeria ...	3,425	21,088	3,417	20,869	404	3,787	36	276
Tunis ...	1,111	2,952	1,185	2,853	153	1,535	49	118
Total ...	222,191	1,668,742	60,704	525,856	121,602	1,051,788	135,677	1,832,675

has deceased from 8·00 cwt. to 7·51 cwt. The total production this year (1,668,742,000 cwt.) is 99·97 per cent. of last year's production (1,669,308,000 cwt.).

Rye.—The area cultivated this year (94,492,000 acres) is 99·4 per cent. of last year's area (95,087,000 acres). The yield per acre has decreased from 7·65 cwt. to 7·47 cwt. The total production this year (706,518,000 cwt.) is 97·0 per cent. of last year's production (728,073,000 cwt.).

Barley.—The area cultivated this year (60,704,000 acres) is 102·8 per cent. of last year's area (59,057,000 acres). The yield per acre has decreased from 9·36 cwt. to 8·66 cwt. The total production this year (525,856,000 cwt.) is 95·1 per cent. of last year's production (553,064,000 cwt.).

Oats.—The area cultivated this year (121,602,000 acres) is 102·3 per cent. of last year's area (118,847,000 acres). The yield per acre has decreased from 9·41 cwt. to 8·65 cwt. The total production this year (1,051,788,000 cwt.) is 94·1 per cent. of last year's production (1,118,307,000 cwt.).

Maize.—The area cultivated this year (135,677,000 acres) is 103·8 per cent. of last year's area (130,722,000 acres). The yield per acre has increased from 12·27 cwt. to 13·50 cwt. The total production this year (1,832,675,000 cwt.) is 114·3 per cent of last year's production (1,603,147,000 cwt.).

Russia.—According to the report of H.M. Consul at Warsaw (Mr. Clive Bayley), dated November 23rd, though the harvest of 1910 in Poland and Grodno was satisfactory, both as regards cereals and potatoes, the result was not so successful financially owing to a general fall in prices. No definite information was then available as to the total yield of potatoes, though it was stated to be very abundant. Prices are lower than last year on account of the larger supply. During the present year potatoes have been exported from Poland to England and France, and prices were quoted at 2*s.* 4*d.* to 2*s.* 8*d.* per korzec of 270 lb., delivered free at any railway station in Poland. H.M. Consul at Odessa (Mr. C. S. Smith) also reports an abundance of the potato crop, prices for good table and industrial potatoes being stated to be very low.

Germany.—The German Imperial Statistical Bureau, in a report dated November 21st, gives the condition of winter wheat as 2·6, and winter rye as 2·7 (2 = good, 3 = average).

French Potato and Apple Crops.—According to an estimate of the French Ministry of Agriculture, the acreage and production of potatoes in France in 1910, as compared with the two preceding years are as follows (*Journal Officiel,* November 22nd) :—

	Area. Acres.	*Production.* Tons.
1910	3,764,000	8,271,000
1909	3,822,000	16,416,000
1908	3,817,000	16,737,000

H.M. Consul at Rouen (Mr. C. Clipperton) in a dispatch dated November 15th has forwarded to the Board reports as to the state of the potato and apple crops in several districts of France.

The potato crop was retarded by wet in the St. Malo district, the earliest crop partially failing and the second early crop, though yielding well, arriving too late for a good export price. There was also a shortage in the yield of late potatoes. Prices are stated to have risen, round potatoes costing £6 12*s*. 6*d*. per ton, and kidneys about £6 18*s*. 6*d*. per ton. In the Nantes district (Department of Loire-Inférieure) the crop was reported to have been ruined by disease. The crop of early potatoes in the district of St. Brieuc (Department of the Côtes du Nord) was stated to be good, but later varieties were a failure.

With regard to apples the crop has failed in many parts of the St. Malo district, prices for cider apples being from £3 9*s*. 6*d*. to £4 9*s*. 6*d*. per ton. A good average crop as regards quantity was expected in the Nantes district, with the continuance of favourable weather, but nothing definite was reported as to quality. In the Consular district of St. Brieuc the crop was very unequal in different parts.

Hop Crop of Southern Russia.—H.M. Consul at Odessa (Mr. Dickie), in a dispatch dated November 10th, states that the hop crop of southern Russia is now placed at 15 to 20 per cent. below the estimates in the early part of the year. The crop is not expected to exceed 2,800 tons, compared with a yield of 3,600 tons in 1909 and 4,300 tons in 1908. The quality is, on the whole, satisfactory, about 50 per cent. being of first grade, 30 per cent. of second, and barely 20 per cent. of third grade.

Argentina.—H.M. Consul at Buenos Aires (Mr. A. Carnegie Ross) reports that, according to final official figures, the results of the harvest of 1909–10 are as follows, compared with the two preceding years :—

	Wheat. Tons.	Linseed. Tons.	Oats. Tons.
1909–10 ...	3,508,000	705,000	521,000
1908–09 ...	4,182,000	1,032,000	457,000
1907–08 ...	5,155,000	1,083,000	485,000

A dispatch from H.M. Consul at Buenos Aires, dated November 6th, states that the general outlook for the crops was said to be very favourable, except in the northern parts of Santa Fé. In the Pampa and some of the western camps the position was still somewhat doubtful, though it had much improved of late, but in the southern portion of Buenos Aires the wheat prospects were much more encouraging than has been the case for years, and unless late frosts occur a large harvest is anticipated.

Potatoes in Canada.—The bulletin issued by the Canadian Census and Statistics Office in November states that potatoes alone of all the field crops of the Dominion indicate partial failure. The area under this crop is 503,262 acres, as compared with 513,508 acres in 1909, and the production is estimated at 74,048,000 bushels, as against 99,087,200 bushels in 1909. The yield per acre in 1910 is thus about 147 bushels, which is nearly uniform for all the provinces of the Dominion. The quality is 84·42 per cent. of a normal.

World's Wheat Crop.—Revised estimates of the world's wheat crop were issued on December 2nd by *Dornbusch's* Evening List, and *Beerbohm's* Corn Trade List. The figures are as follows:—

		Dornbusch. Thousands of Qrs. (measure).	Beerbohm. Thousands of Qrs. (of 480 lb.).
1910	...	453,741	459,100
1909	...	453,831	459,320
1908	...	398,134	402,365
1907	...	388,808	398,975
1906	...	424,372	435,255

United States.—The United States Crop Reporting Board estimates the newly-seeded area of winter wheat at 34,485,000 acres, an increase of 3 per cent. on the area sown in the autumn of 1909. The condition of winter wheat on December 1st was 82·5, as compared with 95·8 in 1909, and 85·3 in 1908, and a ten-year average of 91·3. The area sown with winter rye is estimated at 2,138,000 acres, or a decrease of 17,000 acres compared with 1909. The condition of winter rye on December 1st was 92·6, compared with 94·1 in 1909, 87·6 in 1908, and a ten-year average of 93·5. (*Dornbusch,* December 7th.)

Russia.—The Central Statistical Committee has published the following preliminary figures concerning the Russian grain and potato harvests of 1910 for the seventy-three Governments and Territories of the Empire:—

		Production. Average. 1904–8. Tons.	1909. Tons.	1910. Tons.
Winter rye	...	19,529,000	22,046,000	21,284,000
,, wheat	...	5,206,000	5,523,000	6,641,000
Spring rye	...	423,000	305,000	339,000
,, wheat	...	10,246,000	15,392,000	14,071,000
Barley ...	...	7,424,000	10,117,000	9,805,000
Maize ...	...	1,210,000	995,000	1,934,000
Oats ...	...	13,116,000	16,312,000	14,896,000
Potatoes ...	...	26,996,000	31,835,000	35,602,000

Agricultural Labour in England during November.

The Board of Agriculture and Fisheries have been furnished by the Board of Trade with the following report, based on returns from correspondents in different districts, on the demand for agricultural labour in November:—

Outdoor employment was interrupted to some extent in most districts on account of unfavourable weather, and in consequence day labourers and pieceworkers were generally in somewhat irregular employment. With the exception of one or two districts in the Eastern Counties, there was a plentiful supply of such men, and in a number of cases the supply was more than equal to the demand, which was on the whole only moderate.

Northern Counties.—Day labourers in these counties were principally employed at getting up and storing the root crops, threshing and hedge-trimming, but the amount of work offered was only moderate, and there was a consequent surplus in the supply of labourers in the

Glendale Rural District in *Northumberland,* and in several districts in *Lancashire* and *Yorkshire.* At the hiring fairs for farm servants held in these counties during November no general change in wages on the previous year was reported in *Northumberland.* In *Cumberland, Westmorland,* and *Lancashire* the forward state of farm work lessened the demand for men, and there was a downward movement in wages as compared with a year ago. There was slackness in hiring for a similar reason at several of the *Yorkshire* fairs, but wages in this county on the whole showed little change compared with a year ago.

Midland Counties.—Outdoor employment was interrupted to some extent by frost, rain and snow in these counties, and day labourers and piece-workers lost time in consequence. When the weather permitted there was a fair demand for these men in many districts on account of such work as getting up roots and threshing, and generally the supply of and demand for extra labourers were fairly well-balanced; some surplus in the supply, however, was reported from the Brixworth Rural District in *Northamptonshire,* from the Crowmarsh, Witney, and Woodstock Rural Districts in *Oxfordshire,* and from the Eaton Socon Rural District in *Bedfordshire.*

Eastern Counties.—Threshing, pulling, and storing roots, hedging, ditching, &c., caused a fair demand for day labourers in most districts, and except in a few districts in *Norfolk* and *Suffolk,* where rain stopped work occasionally, these men were generally reported in regular employment. The supply of men was usually equal to the demand, but there was a slight scarcity in the Docking (*Norfolk*) and the Wangford (*Suffolk*) Rural Districts; in the Samford and Thingoe (*Suffolk*) Rural Districts there was some surplus.

Southern and South-Western Counties.—Day labourers lost a few days' employment in most districts on account of wet weather, which seriously interfered with work on the root crops and threshing. The supply of such men was generally well up to a somewhat moderate demand, and in several districts, particularly in *Kent and Sussex,* there was a surplus. Men for permanent situations were reported as scarce in the Godstone (*Surrey*), Petworth (*Sussex*), Bromyard (*Herefordshire*), and the Camelford, Liskeard, Truro, and West Penwith districts (*Cornwall*).

THE CORN MARKETS IN NOVEMBER.

C. KAINS-JACKSON.

November has been marked by corn exchanges almost uniformly in favour of buyers, though at the very close of the month some fresh vigour in inquiry, both retail and speculative, was to be noted. The United States Government report on the maize crop in that country, published on the 11th, disclosed the ingathering of a record crop, nearly two bushels per acre larger than in 1909, and on an extended acreage. This anticipated abundance of the feeding stuff competing most closely with oats prevented the news of a shortish yield of that cereal from helping the market.

Wheat.—The average price of British wheat for the first quarter of the cereal year, September 1st to November 30th, has been 30*s.* 5*d.*, and the November average of 30*s.* augurs a certain loss of ground since

the opening of the season. Sales have not differed materially from those of the like period last year, but the yield was more than six hundred thousand quarters smaller, and consequently the stocks in farmers' hands are materially less than was carried into December, 1909. Mark Lane on the 28th and 30th appeared conscious of this, as despite large offers of imported wheat at reduced prices on the month, English wheat was held with remarkable tenacity. East Kent White made 34*s*. to 35*s*. per 504 lb., best Norfolk Red 34*s*. per 504 lb. The French wheat referred to in market circulars and reports as offered at 31*s*. to 32*s*. per 480 lb., is not wheat grown in France, for that country is an importer, not exporter. It is wheat grown from French seed, and known as Dreadnought, Marvel, Treasure, and Jolly Farmer, for the firms introducing the French sorts have found it advantageous to employ thoroughly English trade names. Chicken wheat of home growth has had a free sale at 29*s*. per 448 lb., but this is by no means cheap by comparison with milling wheat, and, in fact, the price equals 31*s*. per statute quarter of 480 lb. The imported kinds of wheat have ranged from 33*s*. for poor New Zealand, up to 38*s*. for fine Manitoba. Good medium sorts have been Australian at 37*s*., North Russian at 36*s*. 6*d*., white Calcutta at a like price, and the red wheat of the Punjab at 35*s*. 6*d*. to 36*s*. per qr. Large offers of Russian new crop at 30*s*. to 33*s*. have occurred, but this price leaves cleaning and screening work of a costly nature to be done by the miller, and is not therefore nearly so favourable to him as at first glance might appear.

Imports of breadstuffs for the first quarter of the cereal year have not quite equalled those of last season. Shipments have been very heavy, but Continental inquiry has been much above the average. During November Russia sent off 3,115,000 qrs., Europe S.E. 1,170,000 qrs., North America 1,082,000 qrs., South America 218,000 qrs., India 442,000 qrs., and Australasia 317,000 qrs. The quantity on passage on the last day of the month was 2,400,000 qrs., being 160,000 qrs. increase on the thirty days.

Flour.—Few price changes have occurred. Mark Lane on the 30th quoted Top-price at 33*s*., Household at 27*s*. 3*d*., Country Roller Whites at 25*s*., and Stone-ground at 23*s*. 6*d*. per sack for cash. Many, perhaps most, buyers of the ordinary Household sort require credit and delivery, and the official price to these was 28*s*. 6*d*. American flour has not the hold on British markets that it once had, but a moderate trade has been done at 30*s*. for Minneapolis, 29*s*. for Minnesota, and 27*s*. 6*d*. for secondary Kansas. The Canadian flour offering at 27*s*. to 29*s*. gives satisfaction, as does Hungarian at 37*s*. to 38*s*. per sack. America in November shipped 492,000 sacks, a very moderate quantity, and the total on passage at the end of the month, 222,000 sacks, was also quite moderate.

Barley.—The low price accepted for British barley during the first quarter of the new cereal year has been productive of exceptionally large sales at the statute markets, 1,597,800 qrs. against 1,370,680 qrs. last year. The average value during November was 25*s*. 2*d*., but with an upward tendency, particularly in London, towards the close. Imported barley has not sold well, but Californian may be quoted as commanding 30*s*. to 33*s*. per 448 lb., Anatolian (unscreened) 26*s*. to 28*s*.

per 448 lb., and Russian 18*s*. to 19*s*. per 400 lb. November shipments were 2,700,000 qrs. from Russia, 579,000 qrs. from Europe S.E., and 214,000 qrs. from California. The quantity on passage on the 30th was 985,000 qrs., a substantial increase on the month. As, however, imports have been smaller than last season, holders are not depressed.

Oats.—Of this staple the last thirteen weeks' receipts from abroad have been so exceedingly moderate that the market has been able to maintain previous quotations for all the leading foreign descriptions. British oats have been a poor sale; the cause of this is none too clear. Supplies on passage have increased to 440,000 qrs., mainly through Russian shipments, but as 1,077,000 qrs. cleared from that country in November the British purchases cannot be called large in proportion. No other country but Russia is shipping oats at all freely, and a severe winter in Eastern Europe would, it is thought, give decided strength to the oat trade in Great Britain.

Maize.—America in November shipped only 223,000 qrs., but this, of course, was 1909 corn, the new harvest requiring time to dry, &c. Shipments will begin at Christmas, and very large quantities are understood to have been already sold for January and February export direct to the United Kingdom. The market price is down to a guinea per quarter for Argentine, and the value of the new American is 4*s*. 4*d*. per cental for February delivery at Liverpool. The quantity on passage is nearly a million quarters of "old" maize if the Argentine crop secured in April of this year be now ranked as old. November shipments from Argentina were 1,507,000 qrs.

Oilseeds.—Linseed yields on isolated farms have during November been reported at 910 lb. in this country, and 700 lb. per acre in Argentina. The new Argentine crop for February delivery was selling on November 30th at 62*s*. 8*d*. per qr., or 1*s*. 3*d*. rise on the month. The quantities of oilseeds on passage were 32,000 qrs. of linseed, 19,000 qrs. of rapeseed, and 38,700 tons of cottonseed; the last-named ended the month with 8*s*. 6*d*. per cwt. paid for Egyptian.

Various.—Beet-sugar steadied a little, opening at 9*s*., and closing at 9*s*. 1*d*. to 9*s*. 2*d*. per cwt. New winter beans at the last market of the month were making 31*s*. per 532 lb., old crop 2*s*. above this. The best peas were in request, the high price of 110*s*. per 532 lb. being paid for finest hand-picked. New red cloverseed was of good quality, and at three guineas per cwt. was deemed cheap. A like price was asked for fine trefoilseed, which was reported to be scarce.

THE LIVE AND DEAD MEAT TRADE IN NOVEMBER.

A. T. MATTHEWS.

Fat Cattle.—There was a weakening tendency in the cattle trade throughout the month, as will be seen by the following summary of average prices:—Shorthorns in about twenty English markets averaged 8*s*. 2¾*d*., 7*s*. 5*d*., and 6*s*. 6*d*. for the three qualities. This

was a fall of $1\frac{3}{4}d.$ per stone all round. Herefords, $8s.$ $5\frac{1}{2}d.$ and $7s.$ $9\frac{1}{4}d.$, a decline of $1\frac{1}{2}d.$ and $2d.$; Devons, $8s.$ $6d.$ and $7s.$ $8\frac{1}{2}d.$, a decline of $1\frac{1}{2}d.$ and $1d.$; Welsh Runts, $8s.$ $1\frac{1}{2}d.$ and $7s.$ $5d.$, a decline of $2\frac{1}{4}d.$ and $2d.$; Polled Scots, 8s. $3\frac{1}{4}d.$ and $7s.$ $9\frac{3}{4}d.$, a decline of $2\frac{3}{4}d.$ and $2d.$ per stone. Comparing the above average prices with those of the middle of July we find that the total fall amounts to nearly one shilling per stone, or, roughly, $\frac{3}{4}d.$ per lb. on all breeds except Devons, which breed also declined, but to a smaller extent. If we take the English markets for the week ending November 24th we find some startling variations in values for Shorthorns, classed as first quality, at the different markets. Ipswich stood alone in quoting this class at $9s.$ $3d.$ per stone, followed by London at $8s.$ $9d.$, while Bristol, Liverpool, and Wellington were quoted at $7s.$ $10d.$ There is a point in connection with the London quotation which explains much of these extreme differences in prices. On Monday, November 21st, some thirty prime Norfolk Shorthorn bullocks, yard-fed and in ripe condition, were present, and sold very readily at $7\frac{1}{2}d.$ per lb. This was the first arrival of this class, and the previous week, with only grass-fed cattle on offer, the top price was only $6\frac{3}{4}d.$ The report made it appear that Shorthorns had advanced in value at Islington by $\frac{3}{4}d.$ per lb. on the week, while in reality it was entirely a question of difference in quality.

Veal Calves.—The trade in fat calves calls for little comment, the average prices in English and Scottish markets having maintained a singularly uniform level of $8\frac{1}{2}d.$ and $7\frac{1}{2}d.$ per lb. for first and second quality.

Fat Sheep.—For three months there has been virtually no change in the average values of fat sheep. Downs in English markets again averaged $8d.$, $7d.$, and $5\frac{1}{2}d.$ for the three qualities, Longwools averaging just $\frac{1}{2}d.$ per lb. less. There have been good supplies of young sheep on offer, and in London particularly the quality and size of the Down tegs have been far more in consonance with the demand than was the case during the summer and autumn months. Consequently Islington quotations for fat sheep have been relatively high for many weeks past. Hampshire and Suffolk tegs have easily fetched $8\frac{3}{4}d.$ per lb., and Oxfords about $8\frac{1}{2}d.$ The supply of Kent wethers has ceased for the season, but there have been many plain Irish Roscommons of great size, and these have had to be sold at less than $6d.$ per lb. Scotch half-breds and Cheviots have been sparingly offered in London, and have fetched about $8d.$ per lb. The separate quotation of lambs has now ceased for a time, but new season Dorset Horns will soon be on offer.

Fat Pigs.—Values have remained fairly steady through the month, but at a decidedly lower level than that of October. Averages in thirty British markets for bacon pigs were $7s.$ $7d.$ and $7s.$ for first and second quality, which was a decline of $5d.$ per 14 lb. stone on the month. The highest quotations were $8s.$ $5d.$ at Chichester, and $8s.$ $3d.$ at Hereford and Peterborough.

Carcass Beef—British.—There were occasionally good supplies of Scotch beef, but on the whole the quality has scarcely been equal to that of October. The prices, however, were well maintained, the average in Smithfield Market for short sides being $7\frac{1}{2}d.$ and $7d.$, and

for long sides $6\frac{7}{8}d.$ and $6\frac{5}{8}d.$ per lb. English beef was again only represented by second quality, and averaged $5\frac{3}{4}d.$ per lb.

Port-Killed Beef.—The supplies of Deptford-killed American beef have been of middling quality, a large proportion being of the "rancher" class. The month's average at the London Central Market was $5\frac{3}{4}d.$ for the best quality.

Chilled Beef.—There were rather extensive fluctuations in chilled beef, especially in Argentine. United States hindquarters averaged $5\frac{1}{2}d.$ to $6\frac{1}{2}d.$, according to quality. During the first half of the month the great depression caused by over-supply of Argentine continued, but with more moderate arrivals prices then advanced $\frac{3}{4}d.$ per lb., and the average for hindquarters of best quality was $4d.$ per lb. for the month, with $3\frac{1}{2}d.$ for second quality.

Frozen Beef.—Best hindquarters were worth $3\frac{1}{4}d.$ per lb., but only a small business was done.

Carcass Mutton—Fresh-Killed.—Scotch tegs have fetched $7d.$ per lb. in the dead meat market in London, and larger sheep $6\frac{1}{2}d.$ English small west country tegs were worth $6d.$ to $6\frac{1}{2}d.$, and Dutch mutton about the same as English.

Frozen Mutton.—Prices have remained firm for all frozen mutton, and the best New Zealand has usually fetched $4\frac{1}{2}d.$ per lb., with Argentine and Australian about $3\frac{3}{4}d.$ Speculation for forward delivery is now going on at greatly reduced rates.

Carcass Lamb.—A small quantity of "House" English lamb is already on offer, but scarcely quotable as yet. Frozen lamb is very dear, and best New Zealand has sold steadily at $6d.$ per lb.

Veal.—Good veal has met with a very fair demand for the time of year, and prime English has realised from $8d.$ to $8\frac{1}{2}d.$ per lb. Dutch of best quality has made as much money, but with a greater range. Much Dutch veal is sold at $6\frac{1}{2}d.$ per lb.

Pork.—The trade in London has varied considerably according to the weather and supplies. Small dairy-fed pigs make higher prices than those usually quoted, but they are offered in such small numbers that they are regarded as a fancy article. Ordinary British pigs have fetched $7d.$ to $7\frac{1}{2}d.$ per lb., and Dutch $6\frac{1}{2}d.$ to $7\frac{1}{2}d.$ per lb.

THE PROVISION TRADE IN NOVEMBER.

HEDLEY STEVENS.

Bacon.—During the month there has been a reaction from the serious decline in prices of Continental bacon reported last month, and by the end of November quotations showed an advance of from $2s.$ to $4s.$ per cwt., but at the time of writing there were signs that this advance would not be maintained. English and Irish bacon fluctuated slightly during the month, but there has been quite a slump in some cuts of American, more especially in hams. The drop in this description of imported meats has been caused by the lower prices cabled from America, in sympathy with the reduction in the price of live hogs. Late in the month values had gone down to \$6.60 for light

weights, but by the end they had advanced again to $6.70 to $7.25. The top price for the month was $8.50. At the same time last year hogs were selling at from $7.25 to $8.45, and two years ago from $4.75 to $6.30. From now forward the arrivals from America are expected to be larger, which, with the further reduction in prices, ought to still further increase the consumption.

Hogs in Canada are also cheaper, and the manufactured product is now offered at fully 2*d*. per lb. under the extreme rates of a few weeks back.

American lard has experienced a slump in prices, the drop on the month being from 5*s*. to 7*s*. per cwt., and 15*s*. to 16*s*. per cwt. under prices current at the same time last year.

Cheese.—The demand has again been only moderate, and prices showed little change until the third week of the month, when all markets exhibited a little firmer tone; by the end of the month about 1*s*. per cwt. advance was asked and paid. Cables from Canada demanded from 1*s*. to 2*s*. advance, and a few sales were made on these terms. Advices report that the quality of the early November makes is quite equal to the October goods on account of the open weather. Stocks in all Canada were reported to be 260,000 cheese on November 30th, which is about the same as last year.

New Zealand factorymen continue to ask around 58*s*. c.i.f. for their season's output, which importers refuse to pay, so that most of the cheese from this colony will be consigned for sale at market price on arrival, which the New Zealanders anticipate will pay them better than accepting around 55*s*. to 56*s*. c.i.f., which is the buyers' idea of their top value.

Butter.—This trade was again disappointing; however, agents managed to raise spot prices of best Colonial from 2*s*. to 4*s*. during the month, though it is felt by buyers that these present values cannot be maintained, and in consequence they operate from hand to mouth only. The arrivals from the Colonies during December will average about 107,000 boxes of 56 lb. each per week, a considerable increase over last year. Cable advices from both Australia and New Zealand report that the weather conditions are still favourable for a very large make. Imports from Denmark have been fair for the time of year, selling prices were 13*s*. to 15*s*. per cwt. under last year. There were no shipments from Canada or the United States.

Eggs.—There has again been a good demand at high prices, the difficulty being to secure sufficient fresh laid to fill orders. This has driven dealers to work on their contracts for pickled, earlier than customary.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and SCOTLAND in the Month of November, 1910.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	England. First Quality.	England. Second Quality.	Scotland. First Quality.	Scotland. Second Quality.
FAT STOCK :—	per stone.*	per stone.*	per cwt.†	per cwt.†
Cattle :—	s. d.	s. d.	s. d.	s. d.
Polled Scots	8 3	7 10	41 6	37 3
Herefords	8 6	7 10	—	—
Shorthorns	8 3	7 5	40 4	36 5
Devons	8 7	7 8	—	—
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	8½	7½	9	6¾
Sheep :—				
Downs	8	7	—	—
Longwools	7½	6½	—	—
Cheviots	8	7	8¼	7¼
Blackfaced	7¾	6¾	7½	6¼
Cross-breds	8	7¼	8½	7¼
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs :—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	7 8	7 3	7 5	6 5
Porkers	8 3	7 9	7 11	7 0
LEAN STOCK :—	per head.	per head.	per head.	per head.
Milking Cows :—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	23 3	19 8	22 18	18 12
,, —Calvers... ...	22 2	19 2	20 11	17 11
Other Breeds—In Milk ...	19 9	16 14	19 18	16 10
,, —Calvers ...	17 10	16 0	20 6	16 16
Calves for Rearing	2 7	1 16	2 10	1 15
Store Cattle :—				
Shorthorns—Yearlings ...	10 9	9 2	10 5	8 14
,, —Two-year-olds...	14 14	13 1	14 19	12 16
,, —Three-year-olds	17 6	15 8	16 14	14 9
Polled Scots—Two-year-olds	—	—	15 12	13 6
Herefords— ,,	14 19	13 12	—	—
Devons— ,,	13 14	12 9	—	—
Store Sheep :—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	34 2	28 1	—	—
Scotch Cross-breds ...	—	—	26 6	22 4
Store Pigs :—				
Under 4 months	27 11	21 10	23 7	18 8

* Estimated carcass weight.

† Live weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND and SCOTLAND in the Month of November, 1910.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Quality.	Birmingham.		Liverpool.		London.		Manchester.		Edinburgh.		Glasgow.	
		per cwt.		per cwt.		per cwt.		per cwt.		per cwt.		per cwt.	
		s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
BEEF :—													
English	1st	53	0	52	0	—		49	6	57	0*	64	0*
	2nd	48	6	49	0	53	6	47	0	50	6*	59	6*
Cow and Bull ...	1st	46	0	45	6	48	0	44	6	44	6	48	6
	2nd	41	6	38	6	43	0	40	0	38	6	38	6
U.S.A. and Canadian :—													
Port Killed ...	1st	50	0	50	6	53	6	49	0	—		50	6
	2nd	45	6	47	0	50	0	46	0	—		47	0
Argentine Frozen—													
Hind Quarters...	1st	32	6	32	6	30	6	32	0	33	0	31	0
Fore ,, ...	1st	27	0	25	0	25	6	26	0	27	0	25	6
Argentine Chilled—													
Hind Quarters...	1st	36	6	35	0	37	0	35	0	36	6	37	6
Fore ,, ...	1st	27	6	27	6	28	6	27	6	28	0	28	0
American Chilled—													
Hind Quarters—	1st	—		—		60	6	—		61	0	—	
Fore ,, ...	1st	—		—		37	6	—		36	0	—	
VEAL :—													
British	1st	—		78	0	74	6	74	6	—		—	
	2nd	61	0	70	0	66	0	70	0	—		—	
Foreign	1st	—		—		74	6	—		77	6	—	
MUTTON :—													
Scotch	1st	—		66	6	66	0	66	0	61	0	66	0
	2nd	—		62	0	60	6	63	0	52	6	44	6
English	1st	60	6	61	0	59	6	62	6	—		—	
	2nd	—		56	6	55	0	57	6	—		—	
Argentine Frozen ...	1st	33	0	32	6	34	6	32	6	33	0	32	0
Australian ,, ...	1st	31	0	29	6	33	0	29	6	35	0	32	0
New Zealand ,, ...	1st	—		—		41	0	—		—		—	
LAMB :—													
British	1st	—		—		—		—		—		—	
	2nd	—		—		—		—		—		—	
New Zealand ...	1st	55	0	53	6	57	0	53	6	—		53	0
Australian	1st	48	0	48	0	50	0	48	0	—		44	6
Argentine	1st	—		46	6	43	0	46	6	—		43	0
PORK :—													
British	1st	79	6	74	6	71	0	74	6	65	6	63	0
	2nd	70	0	70	0	64	0	70	0	58	6	60	0
Foreign	1st	—		—		66	6	—		—		—	

* Scotch.

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1908, 1909 and 1910.

Weeks ended (*in* 1910)	Wheat. 1908.	Wheat. 1909.	Wheat. 1910.	Barley. 1908.	Barley. 1909.	Barley. 1910.	Oats. 1908.	Oats. 1909.	Oats. 1910.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Jan. 1 ...	35 1	32 0	33 3	26 9	26 7	25 1	18 4	17 4	17 4
„ 8 ...	35 2	32 9	33 6	26 9	26 11	24 11	18 3	17 5	17 2
„ 15 ...	35 5	32 8	33 8	27 1	27 1	24 11	18 5	17 5	17 7
„ 22 ...	35 6	33 2	33 9	26 11	27 3	24 11	18 5	17 8	17 6
„ 29 ...	35 0	33 0	33 6	26 11	27 6	25 0	18 4	17 9	17 4
Feb. 5 ...	34 3	33 4	33 7	26 9	27 7	24 10	18 3	17 10	17 7
„ 12 ...	33 1	33 8	33 4	26 9	27 8	24 9	18 0	17 11	17 11
„ 19 ...	32 6	34 1	33 0	26 5	27 11	24 6	17 11	18 0	18 0
„ 26 ...	30 11	34 5	32 7	26 3	28 0	24 2	17 8	18 0	17 10
Mar. 5 ...	30 5	34 10	32 7	26 1	27 11	24 6	17 8	18 2	18 1
„ 12 ...	31 3	35 8	32 6	26 0	28 4	24 1	17 10	18 2	18 0
„ 19 ...	31 7	35 9	32 6	26 2	28 0	23 6	17 11	18 5	18 0
„ 26 ...	31 4	36 0	32 9	25 10	28 0	23 7	17 10	18 6	17 11
Apl. 2 ...	31 3	36 5	33 0	25 5	27 10	23 8	17 9	18 8	18 0
„ 9 ...	31 2	37 4	33 6	25 10	28 0	23 1	17 7	18 10	17 11
„ 16 ...	30 11	38 7	33 7	26 1	27 8	23 5	17 7	19 2	18 3
„ 23 ...	30 10	41 4	33 7	25 5	28 2	23 0	17 9	19 9	18 3
„ 30 ...	31 6	42 5	33 0	25 8	27 10	22 10	18 0	20 0	18 3
May 7 ...	32 4	40 9	32 6	25 5	27 7	22 7	18 4	20 3	18 2
„ 14 ...	33 1	41 6	32 1	24 9	27 3	22 0	18 7	20 6	18 1
„ 21 ...	33 8	42 8	31 10	25 9	27 0	21 8	18 10	20 11	17 8
„ 28 ...	33 5	42 6	31 3	24 6	26 3	21 4	18 8	21 0	17 10
June 4 ...	33 1	43 1	30 2	25 10	25 7	21 8	18 4	21 3	17 10
„ 11 ...	32 7	42 11	29 1	24 5	26 10	20 9	18 4	21 4	17 10
„ 18 ...	32 0	42 7	29 0	24 2	26 10	18 11	18 5	21 6	18 0
„ 25 ...	31 5	42 8	29 4	24 0	27 2	20 1	18 7	21 7	17 9
July 2 ...	30 11	42 9	29 9	23 11	27 2	19 11	18 7	21 9	17 7
„ 9 ...	30 5	43 0	30 4	24 4	26 4	19 5	18 5	21 8	17 4
„ 16 ...	30 7	43 3	31 1	23 1	26 10	21 3	18 5	21 9	17 7
„ 23 ...	31 5	44 0	31 11	26 5	27 4	19 9	18 6	22 5	17 5
„ 30 ...	31 10	43 5	33 5	24 4	24 6	20 10	18 7	22 2	18 1
Aug. 6 ...	31 6	44 9	33 9	23 1	27 4	20 5	18 9	22 11	18 3
„ 13 ...	31 6	44 9	33 5	23 10	24 9	20 4	18 1	21 8	18 0
„ 20 ...	31 2	41 6	32 11	24 5	23 11	20 11	17 10	19 8	17 11
„ 27 ...	30 10	38 5	32 7	24 5	24 7	20 10	17 1	19 4	17 2
Sept. 3 ...	30 10	37 2	32 2	25 5	26 3	22 10	17 3	19 6	17 2
„ 10 ...	31 5	34 11	31 11	25 11	26 1	23 3	17 6	18 5	17 2
„ 17 ...	31 7	33 6	30 11	26 0	26 5	24 3	17 3	17 9	16 6
„ 24 ...	31 5	32 9	30 2	26 8	26 8	24 2	17 2	17 7	16 3
Oct. 1 ...	31 7	32 2	30 1	26 11	26 9	24 4	17 2	17 2	16 4
„ 8 ...	31 5	31 8	30 1	27 5	26 9	24 7	17 0	17 0	16 3
„ 15 ...	31 2	31 4	30 2	27 6	27 0	25 1	17 0	17 0	16 2
„ 22 ...	30 11	31 8	30 4	27 5	27 7	25 3	16 11	16 11	16 1
„ 29 ...	30 8	31 10	30 4	27 5	27 9	25 4	16 11	17 0	16 2
Nov. 5 ...	30 11	32 5	30 4	27 6	27 9	25 6	17 0	17 0	16 2
„ 12 ...	31 2	32 5	29 11	27 4	27 7	25 4	17 0	17 1	15 11
„ 19 ...	31 10	32 7	29 8	27 3	27 0	25 1	17 3	17 4	16 1
„ 26 ...	32 3	33 0	29 11	27 2	26 8	24 10	17 5	17 3	16 4
Dec. 3 ...	32 7	33 3	30 6	27 2	26 1	24 7	17 4	17 4	16 7
„ 10 ...	32 8	33 3	30 9	27 0	25 7	24 3	17 4	17 3	16 9
„ 17 ...	32 9	33 2		26 9	25 3		17 3	17 4	
„ 24 ...	32 2	33 1		26 8	25 2		17 2	17 4	

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE, BELGIUM, and GERMANY, and at PARIS, BERLIN, and BRESLAU.

—		Wheat.		Barley.		Oats.	
		1909.	1910.	1909.	1910.	1909.	1910.
		s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
France:	October	39 6	46 4	25 4	25 7	20 3	21 0
	November	39 7		25 4		20 4	
Paris:	October	40 6	48 10	24 8	25 5	19 5	21 6
	November	40 3		24 8		19 8	
Belgium:	September	35 6	33 5	24 3	21 10	20 5	19 9
	October	35 11	33 7	24 2	22 6	19 5	18 11
Germany:	September	44 1	41 0	27 3	25 4	21 6	20 2
	October	44 1	40 11	27 6	26 8	21 2	20 9
Berlin:	September	45 8	43 6	—	—	21 10	20 9
	October	47 2	43 1	—	—	21 3	20 3
Breslau:	September	43 10	38 3	28 8* 25 1†	25 10* 22 11†	26 5	20 3
	October	44 10	38 5	27 2* 25 1†	25 9* 22 11†	20 4	20 7

* Brewing. † Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*, the prices for the German Empire representing the average of the prices at a number of markets.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of November, 1909 and 1910.

—	Wheat.		Barley.		Oats.	
	1909.	1910.	1909.	1910.	1909.	1910.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
London	33 5	31 2	26 2	25 5	18 1	17 4
Norwich	32 7	30 6	25 7	24 2	16 8	16 2
Peterborough	32 1	29 5	28 4	25 11	16 6	15 8
Lincoln	31 6	29 5	28 4	25 3	17 0	16 4
Doncaster	31 0	29 8	27 0	23 7	17 2	15 11
Salisbury	33 5	29 9	27 9	23 3	17 5	16 1

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND and SCOTLAND in the Month of November, 1910.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Bristol.		Liverpool.		London.		Glasgow.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. a.*	*s. d.*	*s. d.*	*s. d.*
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12lb.
British ..	14 6	13 6	—	—	15 6	14 0	14 9	—
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery	114 0	110 6	108 0	105 0	113 6	110 0	113 0	—
,, Factory	102 0	94 6	97 6	89 6	101 0	95 6	—	—
Danish ..	—	—	117 0	114 0	116 0	114 0	117 0	—
French ...	—	—	—	—	116 6	113 0	—	—
Russian ...	106 0	100 0	103 0	98 0	103 6	101 6	104 6	101 6
Canadian ..	114 0	110 0	107 0	103 6	—	—	—	—
Australian ...	112 0	101 6	108 0	104 0	108 6	105 6	113 0	110 0
New Zealand	114 0	110 0	113 0	111 0	111 6	109 0	114 0	—
CHEESE :—								
British—								
Cheddar ...	74 0	59 0	73 0	68 6	75 6	71 0	59 6	56 6
			120 lb.	120 lb.	120 lb.	120 lb.		
Cheshire ...	—	—	74 0	64 6	77 6	68 6	—	—
			per cwt.	per cwt.	per cwt.	per cwt.		
Canadian ...	56 0	54 0	56 6	53 6	57 0	56 0	56 6	54 0
BACON :—								
Irish	70 6	67 0	70 6	65 6	71 0	67 6	73 6	70 0
Canadian ...	65 0	61 6	64 6	61 6	64 6	62 0	65 0	63 0
HAMS :—								
Cumberland ...	—	—	—	—	122 0	111 0	—	—
Irish	—	—	—	—	115 0	109 6	96 0	87 0
American (long cut) ...	79 6	72 0	74 6	63 6	81 0	72 0	69 6	66 0
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British ...	17 8	16 0	—	—	20 0	18 4	—	—
Irish	14 10	13 10	15 3	14 1	15 10	14 3	14 1	12 8
Danish ...	16 6	15 6	15 6	14 10	17 2	14 10	15 4	13 9
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Edward VII...	83 6	73 6	65 0	—	76 0	66 0	—	—
Langworthy ...	82 6	70 0	81 6	75 0	86 0	78 6	66 0	61 0
Up-to-Date ...	81 0	67 6	65 0	60 0	80 0	71 0	56 0	51 0
HAY :—								
Clover ...	90 0	75 0	92 6	70 0	100 0	83 6	75 0	68 0
Meadow ...	77 6	52 6	—	—	89 0	66 6	—	—

DISEASES OF ANIMALS ACTS, 1894 to 1910.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(*From the Returns of the Board of Agriculture and Fisheries.*)

Disease.	November.		Eleven Months ended November.	
	1910.	1909.	1910.	1909.
Swine-Fever:—				
Outbreaks	140	114	1,395	1,546
Swine Slaughtered as diseased or exposed to infection ...	1,397	730	13,040	13,591
Anthrax:—				
Outbreaks	107	99	1,341	1,199
Animals attacked	129	112	1,591	1,552
Foot-and-Mouth Disease:—				
Outbreaks	—	—	2	—
Animals attacked	—	—	15	—
Glanders (including Farcy):—				
Outbreaks	15	47	337	509
Animals attacked	36	91	977	1,702
Sheep-Scab:—				
Outbreaks	45	63	412	561

IRELAND.

(*From the Returns of the Department of Agriculture and Technical Instruction for Ireland.*)

Disease.	November.		Eleven Months ended November.	
	1910.	1909.	1910.	1909.
Swine-Fever:—				
Outbreaks	6	1	88	87
Swine Slaughtered as diseased or exposed to infection ...	204	1	2,073	1,562
Anthrax:—				
Outbreaks	—	—	7	8
Animals attacked	2	—	12	8
Glanders (including Farcy):—				
Outbreaks	—	—	1	—
Animals attacked	—	—	2	—
Sheep-Scab:—				
Outbreaks	32	43	419	373

ADDITIONS TO THE LIBRARY.

[NOTE.—The receipt of *annual* publications of foreign agricultural and other departments, experiment stations and societies is not noted in the monthly list of additions to the Library. A list of these publications appeared in the *Journal* for October, November and December, 1909.]

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U.S. Dept. of Agriculture, Office of Experiment Stations.—Circ. No. 102:—Food and Nutrition Investigations of the Office of Experiment Stations—Organisation and Publications. (22 pp.) Washington, 1910. [B. 7.]

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U.S. Dept. of Agriculture, Bureau of Plant Industry.—Bull. No. 191:—The Value of First-Generation Hybrids in Corn. (45 pp.) Washington, 1910. [B. 17; C. 20.]

U.S. Dept. of Agriculture.—Farmers' Bull. No. 419:—Experiment Station Work, LIX. (24 pp.) Washington, 1910. [B. 46.]

Michigan Agricultural College Experiment Station.—Bull. No. 263:—Fertiliser Analyses. (31–74 pp.) East Lansing, Michigan, 1910. [B. 26.]

University of Illinois Agricultural Experiment Station.—Circ. No. 141:—Crop Rotation for Illinois Soils. (20 pp.) Urbana, Illinois, 1910. [A. 80.]

Buchanan, H. B. M.—To Work a Grass Holding at a Living Profit and the Cheap Cottage Problem. (102 pp.) London: Constable and Co., 1910. 1*s.* net. [B. 8–3; M. 2.]

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Michigan Agricultural College Experiment Station.—Bull. No. 259 :—Bean Production. (85–97 pp.) [C. 38.] Special Bull. No. 52 :—Corn Production in the Upper Peninsula of Michigan. (8 pp.) [C. 20.] Circ. No. 9 :—Vinegar and its Making. (2 pp.) [C. 14.] East Lansing, Michigan, 1910.

Plant Diseases—

Collinge, W. E.—The Fauna of the Midland Plateau : A Preliminary List of the Thysanura and Collembola. (14 pp.) Birmingham : Natural History and Philosophical Soc., 1910. 6*d.* [E. 2.]

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Michigan Agricultural College Experiment Station.—Bull. No. 258 :—Insects of Field Crops. (33–84 pp.) [E. 40–11.] Special Bull. No. 53 :—Grasshoppers and their Control. (7 pp.) [E. 40–53.] Special Bull. No. 51 :—Spray and Practice Outline for Fruit Growers. (16 pp.) [E. 20–5.] East Lansing, Michigan, 1910.

Michael, A. D.—British Tyroglyphidæ. 2 vols. (291+183 pp. and xxxix. plates.) London : Ray Society, 1901 and 1903. [E. 40–1.]

India.—Forest Pamphlet No. 15 :—A Note on the Preservation of Bamboos from the Attacks of the Bamboo Beetle or "Shot-Borer." (18 pp.) Calcutta : Superintendent Government Printing, 1910. 8*d.* [E. 40–13.]

Live Stock—

Colorado Agricultural College Experiment Station.—Bull. No. 151 :—Ration Experiment with Lambs, 1906–7, 1907–8. Self Feeders for Hay. (8 pp.) Fort Collins, Colorado, 1910. [F. 76–1.]

University of Wisconsin, Agricultural Experiment Station.—Circ. of Information No. 17 :—Draft Horse Judging. (26 pp.) [F. 62–5.] Research Bull. No. 9 :—The Nature of the Acid-Soluble Phosphorus Compounds of some Important Feeding Materials. (95–106 pp.) [F. 74–1.] Madison, Wisconsin, 1910.

Michigan Agricultural College Experiment Station.—Bull. No. 261 :—Baby Beef Production. (185–213 pp.) East Lansing, Michigan, 1910. [F. 68–3.]

Veterinary Science—

Canada, Commission of Conservation, Committee on Public Health.—Report of the International Commission on the Control of Bovine Tuberculosis. (41 pp.) Ottawa, 1910. [H. 54–3.]

U.S. Dept. of Agriculture, Bureau of Animal Industry.—Bull. No. 125, Part I:—The Gid Parasite and Allied Species of the Cestode Genus Multiceps—Historical Review. (68 pp.) Washington, 1910. [H. 50–1.]

Michigan Agricultural College Experiment Station.—Circ. No. 8:—Tuberculosis. (57–63 pp.) East Lansing, Michigan, 1910. [H. 54–1.]

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Economics—

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Bavaria, K. Statistische Landesamt.—Die Landwirtschaft in Bayern nach der Betriebszählung vom 12 Juni, 1907. (225 pp.) Munich: J. Lindauersche, 1910. [N. 44–7; A. 28.]

Nielsen, A., and others.—Le Mouvement Coopératif en Danemark. (41 pp.) Copenhagen, 1910. [N. 4–7.]

Denmark, Bureau Statistique de l'Etat.—Coopération dans l'Agriculture en Danemark. (30 pp.) Copenhagen, 1910. [N. 4–7.]

Institut International d'Agriculture.—Statistiques des superficies cultivées, de la production végétale et du bétail dans les pays adhérents. (168 pp.) 5 fr. [N. 44–1.] L'Organisation des services de statistique agricole en Suède. (24 pp.) 1 fr. [N. 44–9.] Rome, 1910.

Williams, J., and *Williams, T. C.*—Principles of the Law of Real Property. 21st edition. (759 pp.) London: Sweet and Maxwell, 1910. [N. 10–1.]

Spain, Consejo Provinciale de Agricultura y Ganaderia de Barcelona.—Informe . . . sobre fondacion de Cajas rurales de Credito. (12 pp.) Barcelona, 1910. [N. 6–5.]

Ehrenberg, R. (edit.).—Landarbeit und Kleinbesitz. Heft 10, Die Forstarbeiterfrage. (263–338 pp.) Berlin: Paul Parey, 1910. [N. 22–7.]

Census of Production (1907), Preliminary Tables, Part V. [Cd. 5397] (49 pp.) London: Wyman and Sons, 1910. $5\frac{1}{2}d.$ [N. 40.]

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[Books may be borrowed from the Board's Library on certain conditions, which may be ascertained on application. The volumes marked * are not available for lending.]

SELECTED CONTENTS OF PERIODICALS.

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Agricultural Progress in the Tropics, Part II., *J. C. Willis.* (Sci. Prog., No. 18, October, 1910.) [B. 8–5.]

The Ammonia in Soils, *E. J. Russell.* [B. 40–9.] Studies of the Changes occurring in heated soils, *S. U. Pickering.* [B. 40–1.] Plant-growth in heated soils, *S. U. Pickering.* [B. 40–1.] (Jour. Agr. Sci., Vol. III., Part 3, 1910.)

Field Crops—

Wheat-Growing and its Present-Day Problems, *E. J. Russell.* (Sci. Prog., No. 18, October, 1910.) [C. 2–1.]

Plant Diseases—

Some Remarks on the Parasites of the Large Larch Sawfly, *Nematus erichsonii, J. Mangan.* (Jour. Econ. Biol., Vol. 5, No. 3, 1910.) [E. 40–43.]

Injurious Insects and other Animals observed in Ireland during the year 1909, *G. H. Carpenter.* (Econ. Proc. Roy. Dublin Soc., Vol. II., No. 2, 1910.) [E. 2.]

The Symptoms of Internal Disease and Sprain (Streak-disease) in Potato, *A. S. Horne.* (Jour. Agr. Sci., Vol. III., Part 3, 1910.) [E. 60–37.]

The Effect of Earthworms on Soil Productiveness, *E. J. Russell.* (Jour. Agr. Sci., Vol. III., Part 3, 1910.) [E. 40–53; B. 40–1.]

Live Stock—

The Feeding Value of Mangels, *T. B. Wood.* (Jour. Agr. Sci., Vol. III., Part 3, 1910.) [F. 74–1.]

Dairying—

The Separate Inheritance of Quantity and Quality in Cows' Milk, *J. Wilson.* (Sci. Proc. Roy. Dublin Soc., Vol. XII., No. 35, 1910.) [G. 56–7.]

Birds, Poultry, Bees, &c.—

Poultry-keeping and the Preservation of Foxes, *Joint Report of the Conference, consisting of Representatives of the Poultry Club, the Utility Poultry Club, and the National Poultry Organisation Society to their Respective Societies.* (Jour. Nat. Poultry Organ. Soc., Vol. IV., No. 4, 1910.) [K. 12–3.]

Forestry—

Die Düngung im forstlichen Grossbetriebe, *Dr. Schwappach.* (Mitt. Deut. Landw. Gesell., September 24th, 1910.) [L. 20–7.]

Economics—

Italy.—Règlement pour l'exécution de la loi du 2 janvier, 1910, No. 7, sur le crédit agricole. (Bul. Mens. Off. Renseig. Agr. [Paris], No. 9, September, 1910.) [N. 6–5.]

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THE CULTIVATION OF THE SUGAR-BEET.*

THE sugar-beet, of which there are many varieties, has been derived, like the mangold and garden beet-root, from the wild *Beta maritima* or *Beta vulgaris* of the sea coast. In appearance it somewhat resembles a small white-fleshed mangold, but it lies more deeply in the soil, has a longer tap-root, and is harvested with greater difficulty. During the past thirty years the sugar-beet has become of ever-increasing importance as a source of sugar for human consumption, until at the present day it represents an annual trade of many millions sterling. The percentage content of sugar in the best types of sugar-beet thirty years ago was much lower than at present, but the care bestowed in the form of cultivation and selection has steadily increased the amount of sugar present, as is shown by the following figures (Wood and Berry):—

Year.		Sugar in Juice. Per cent.	Year.		Sugar in Juice. Per cent.
1860–1	...	10·93	1882–3	...	13·60
1868–9	...	11·34	1885	...	14·00
1870–2	...	11·80	1886	...	15·00
1873–4	...	12·65	1889	...	15·04

Since the last date quoted (1889) sugar-beets have been still further improved, and roots are now raised containing 16 to 19 per cent. of sugar, most of which is extractable.

Owing to the conviction that the cultivation of the sugar-beet is commercially possible in the southern half of Great

* This article is based on the general practice of sugar-beet growing on the Continent, especially in France and Germany. A list of the authorities referred to is given at the end of the article.

Britain, farmers are now taking considerable interest in the subject, and endeavours are being made to demonstrate practically the profitable character of the crop in relation to its conversion into sugar in Britain. Farmers are being asked to support the foundation of factories for the manufacture of beet sugar by undertaking to raise a definite acreage of the crop and supply the produce to the factories at a rate per ton agreed upon beforehand.

The general principles underlying the cultivation of the sugar-beet are therefore of interest to British farmers, and it is proposed to give a few notes showing the importance of the crop and the manner in which it is grown on the Continent.

The Importance of Sugar-beet to Agriculture.—Hollrung says that in Germany the cultivation of sugar-beet has raised the yields of grain, rendered possible the keeping of more stock, and consequently increased the output of dung for the benefit of soil and crops. On one farm, which commenced growing sugar-beet in 1883, the average yield of wheat for the six years 1883–8 was 17 bushels (of 60 lb.) per acre, but in the years 1889–1894 the average yield had risen to 19·8 bushels per acre. In a district of Hildesheim the stock kept before and after the introduction of sugar-beet growing (1870 and 1890 respectively) were as follows:—

	1870.	1890.
Work Oxen	106	594
Cows and other cattle	3,431	5,469
Young stock	732	1,087
Fattening cattle	635	2,681
Pigs	3,146	9,119

Lilienthal estimated, on the basis of eight farms, that the introduction of the cultivation of sugar-beet had led to the folowing increases:—

Increase of live stock in the ratio	100 : 115
Increase in corn production in the ratio	100 : 111
Increase in dung production in the ratio	100 : 132
Increase in wages in the ratio	100 : 141
Increase in net profit in the ratio	100 : 134

It is probable that these increases are to be attributed to the introduction of a profitable root crop where such a crop was not previously grown. The increases would not be applicable in Great Britain, where root crops have long held

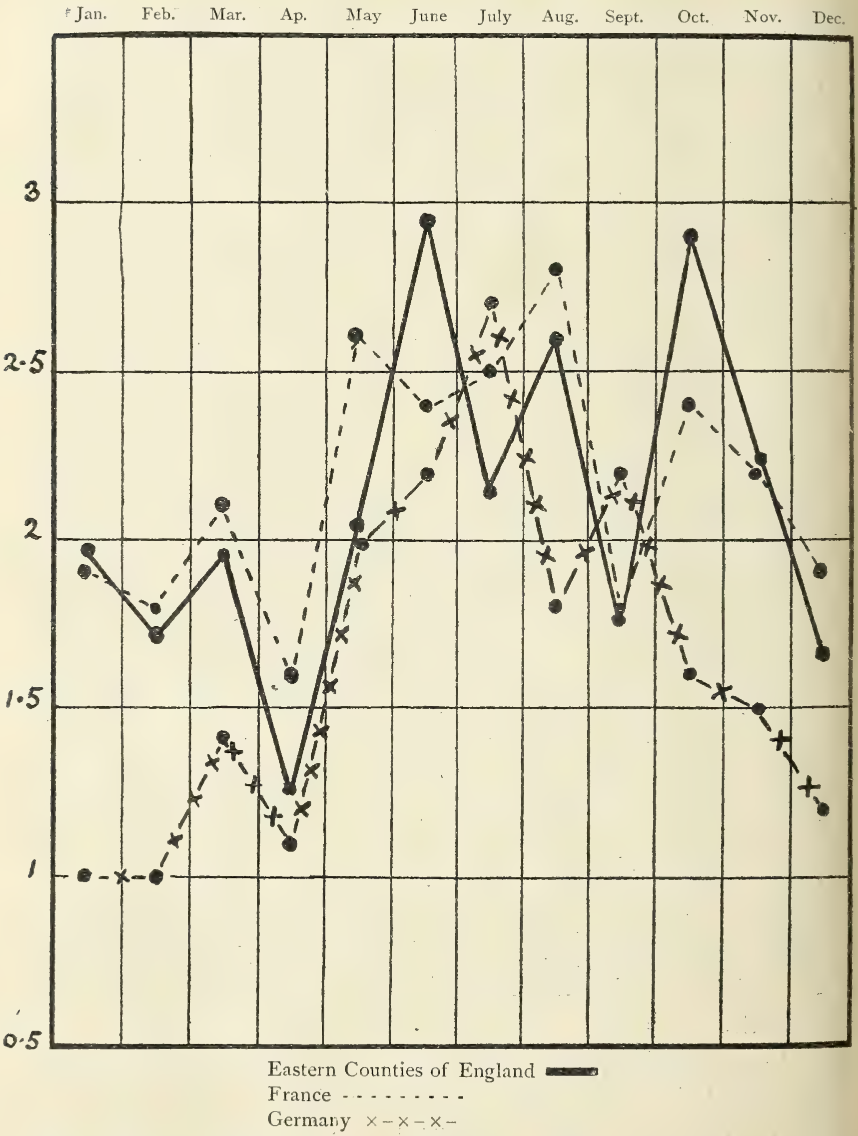
an important place in farm economy, but the profit, if any, would be that of sugar-beet over mangolds.

Climate.—The influence of climate is considerable, temperature, rainfall and sunshine all having a direct effect on the successful cultivation of the crop, especially as regards percentage contents of sugar. By comparisons of meteorological observations since 1870 M. Pagnoul has concluded that the temperature in May, June, and July has a preponderating influence on the yield of the crop, and that of September a very marked effect on quality. Lawes and Gilbert remarked in 1898 that "those who have thoroughly studied the question of the most suitable temperature for the growth of sugar-beet, come to the conclusion that a summer *mean temperature* of not less than 70° F. is desirable to ensure success." These writers also endeavoured to show that the mean temperature of the East and South of England is not nearly up to the 70° F. standard during June, July, August and September, and they argued that "so far as temperature is concerned, we should be at a disadvantage compared with other beetroot sugar producing countries." "Nevertheless," they added, "it is probable that, in the majority of seasons, sugar-beet could be grown of fair quality for sugar-making in the most favourable districts of the country, which would be in the eastern and southern counties." The results of experiment since Lawes and Gilbert wrote show that a mean summer temperature of 70° F. is by no means necessary, for heavy crops containing a high average percentage of sugar have in many cases been grown in the eastern counties. In fact, as Petermann and Pagnoul appear to have found, the quantity of organic matter produced by the sugar-beet probably depends more on light and rainfall than on the total heat received during growth.

The sugar-beet crop has need of considerable water, transpiration being heavy, and Hollrung states that for the growth of 1 lb. of dry matter (= about 4 lb. of the green plant), 40 gallons of water are necessary. As with other root crops, however, prolonged rains may be harmful owing to the difficulty experienced in keeping the crop clean.

The diagram on p. 796 shows graphically the average

rainfall of certain great sugar-beet growing centres in France and Germany compared with the average of centres in the eastern counties of England. In arriving at the figures for the English district, the monthly averages were taken for



Cambridge, Hillington, and Rothamsted for the five years 1902-6, and the graph represents the monthly averages for these three centres for the years named, that is, the average of fifteen sets of figures. In the case of France and Germany the monthly averages have been taken in the same way, the

centres for the French district being Arras, Amiens, and Soissons (four years only), and for the German district, Halle, Magdeburg, and Erfurt (four years only).

A comparison of the figures shows that in April all three districts have a rainfall between 1 in. and 1·6 ins.; in May the rainfall for the English and German centres is almost identical (2 ins.), while that for France is 2·6 ins.; in June—a month when plentiful rain is needed for the crop—the English centre has a distinct advantage, which is, however, lost in July but recovered in August; and in the critical month of ripening—September—the three districts may be considered about equal. On the whole, therefore, the eastern counties appear to compare very favourably as regards rainfall with two typical sugar-beet growing districts in France and Germany, and are not apparently at a disadvantage in this respect.

Warmth, sunlight, sufficient soil moisture, and a supply of soluble food material, are requisite to enable the plant to manufacture chlorophyll, assimilate carbon dioxide from the atmosphere for the manufacture of starch, and to maintain the necessary transpiration.

Soils.—As regards soil the sugar-beet may be compared with the mangold, but owing to the cost of harvesting it cannot be grown profitably on the heavy clays on which the latter crop is frequently so successful. It is suited for good, open, deep loams which are cool without being wet, also for sandy and calcareous loams if moderately supplied with humus. A good mellow soil adapted for growing barley and swedes, easy to work, and readily penetrated by roots, if in a suitable climate, would grow sugar-beet well. It is important that the soil be deep, porous, easily worked, and well drained.

The sugar-beet appears to be very responsive to lime, and good results are obtained on chalk soils, while on the Continent moorland soils are found to be quite suitable for sugar-beet cultivation after being ameliorated by the use of sand and by draining. Experiment gave the following results:—

			Yield per acre.			
Sandy soil	76 per cent.	quartz	0·81	ton from	15,140	plants
Clay ,,	47 ,,	clay	0·89	,,	12,140	,,
Chalk ,,	74 ,,	chalk	15·68	tons from	16,110	,,
Moorland soil	68 ,,	peat	13·16	,,	12,550	,,
Mixture of equal parts of the above soils		...	23·54	,,	15,870	,,

The sugar-beet is grown to perfection on the rich loams of Saxony, between Magdeburg and Halle, in mid-Silesia, Brunswick and Anhalt; it is also grown on heavy soils in Westphalia, Thuringia, Saxony, the Northern and Southern slopes of the Harz, and on light soils in Mecklenburg, Pomerania, Southern Posen and Altmark. In France sugar-beets are chiefly grown in the following Departments:—Aisne, Nord, Oise, Pas-de-Calais, Somme, Seine-et-Marne.

Rotation of Crops.—A satisfactory rotation is of considerable importance, and the sugar-beet should only be grown on the same land once in three or four years; if grown too frequently the crop is liable to be small and the sugar content reduced, while the multiplication of parasites, such as eel-worms, is much favoured. It seems, in fact, that with repeated cultivation on the same soil the land becomes "beet-sick."

In the rotations chiefly followed in France, sugar-beet leads the rotation, and is manured, wheat following it. In order to provide a better division of labour, give more time for tillage operations, and permit the keeping of more stock and the improvement of the soil by the growth of leguminous crops, the following rotation has been suggested:—sugar-beet, oats, clover, wheat. This rotation, on the other hand, exposes the oats to "lodging," while it does not give a sufficiently important place to wheat.

The following are examples of rotations practised in different localities on the Continent.

	FRANCE.		AUSTRIA.		BELGIUM.
	Nord.	Pas-de-Calais.	Bohemia.	Bohemia—Moorland Soil.	Hainault.
1st year	Sugar-beet	ugar-beet	Sugar-beet	Sugar-beet	Sugar-beet
2nd ,,	Wheat	Wheat	Spring cereal	Straw crop	Wheat
3rd ,,	Oats	Oats	Sugar-beet	Sugar-beet	Oats or rye with clover
4th ,,	—	Clover and annual fodders	Spring cereal	Straw crop	Clover
5th ,,	—	—	Red clover	Fodder crop	Wheat or winter barley
6th ,,	—	—	Winter cereal	Straw crop	—

GERMANY.

	Saxony.	Magdeburg.	Hanover.	Saxony.	Posen.
1st year	Sugar-beet	Sugar-beet	Potatoes with dung	Lucerne—four years	Winter cereal
2nd ,,	Potatoes	Barley or oats	Sugar-beet	Potatoes	Sugar-beet or potatoes
3rd ,,	Winter cereal	Clover, peas or vetches	Winter cereal	Wheat	Barley or oats
4th ,,	Sugar-beet	Wheat	Oats or barley	Sugar-beet	Rye
5th ,,	Spring cereal or peas	—	—	—	Sugar-beet or potatoes
6th ,,	Winter cereal	—	—	—	Potatoes
7th ,,	—	—	—	—	Barley or oats
8th ,,	—	—	—	—	Clover

It is clear that the rotation must vary widely according to the particular circumstances; thus in sugar-beet growing districts the area occupied annually by this crop varies from 11 to 33 per cent. of the farm. Hitier recommends the adoption of a rotation in which lucerne or other leguminous fodder crop takes a large place, in order to bring the sugar-beet crop to a just proportion, avoid the increase in fungus and insect pests, and permit the maintenance of a large head of stock to produce dung. Long rotations are sometimes practised; thus in Saxony a rotation followed on some of the better sandy-loam soils is:—Sugar-beet with dung, wheat, rye, potatoes with dung, oats with clover, clover, wheat with dung, sugar-beet, barley, rye, sugar-beet with dung, wheat.

It is believed in Germany that sugar-beets after clover are usually attacked by insects and also ripen later, but Kiehl found, on the basis of 14 years' observations, that sugar-beets after clover gave a considerably higher average yield than sugar-beets after wheat. The 14 years' average was as follows:—

After wheat	... ...	11·10 tons per acre with 1·60 tons of sugar
,, clover	... ..	12·27 ,, ,, ,, 1·73 ,, ,,

This shows a greater average yield of 1·17 tons of sugar-beet containing over $2\frac{1}{2}$ cwt. more sugar after clover than after wheat.

Manuring.—The manuring of the sugar-beet is a question of great importance, and it is necessary to consider not only the kind and quantity of manures to use, but the time and

method of distributing them, while the rotation adopted must also be taken into account. Though the sugar-content of the sugar-beet is large, this in itself does not mean the extraction from the soil of any of the fertilising elements; the sugar is formed in the leaves, chiefly at the expense of the carbon dioxide of the air. In order that the sugar-beets may grow well and rapidly, however, to supply the rest of the plant constituents, and to enable the accumulation of the sugar to take place in the root, the crop requires a complete manuring with dung and artificial fertilisers. This manuring is not lost when the crop is harvested. The sugar is certainly extracted for human consumption, but a large part of the plant food is returned to the soil in the leaves and crowns of the crop, while the pulp from which the sugar has been removed is fed to stock and thus in part converted into meat and milk, and in part returned to the soil as dung. Use is also made of other residual products. When the pulp is fed to stock and the dung is well managed, the manurial losses are small and comparable to those which take place in feeding mangolds. If the pulp is not fed the losses are heavy, as when roots are sold off the land. For the purpose of raising a crop of sugar-beets, however, large quantities of nitrogen, phosphoric acid, potash, and lime are required, and the percentage of the chief ingredients appears to vary with the sugar-content, beets rich in sugar taking comparatively less from the soil than those which are poor in sugar. According to Garola, lime and nitrogen are the ingredients most favourable to the crop during the first two months after the sowing of the seed, after which phosphoric acid and potash are increasingly required, though lime is the dominant ingredient to the end of growth. The practical conclusion derived from a consideration of the movements of absorption seems to be that the sugar-beet needs moderate manuring with dung, fortified with superphosphate, nitrate of soda (or sulphate of ammonia), and a potash manure.

The quantities of manures recommended are from 8 to 12 and not more than 16 tons per acre of dung, according to the soil and conditions of cropping; with $2\frac{1}{2}$ to $4\frac{1}{2}$ cwt. of superphosphate, $1\frac{1}{2}$-2 cwt. nitrate of soda, and $1\frac{1}{2}$ cwt. sulphate of potash or 6 cwt. of kainit. Artificials are usually distributed

broadcast, and with the exception of nitrate of soda, may be ploughed in or drilled. In experiments conducted in Germany between 1890 and 1899 on over 1,700 acres, Kiehl found that nitrate of soda gave the best results as a top-dressing applied in three lots, viz., when the seedlings first appear, and after the first and second hoeings. It may, however, be applied at two operations, half before sowing, and half after singling. On sandy and moorland soils basic slag may be used, being distributed in the autumn previous to sowing the seed.

In general, manuring for sugar-beets may be on the basis of manuring mangolds, but it should be remembered that only about half the weight of roots can be grown, and that large quantities of forcing manures like rotted dung or nitrate of soda may injure the quality. For medium loams in the South of England the following manuring would probably be found to be satisfactory:—10–12 tons of dung ploughed in after harvest, with 1 cwt. sulphate of ammonia, 4 cwt. superphosphate, and $\frac{3}{4}$ cwt. sulphate of potash applied before sowing, and $\frac{1}{2}$ cwt. nitrate of soda applied as a top-dressing after singling. It is, however, advisable that trials with various quantities of manures should be made on every farm and each type of land when the first crop is grown, so that information suitable to local conditions may be obtained.

In describing a visit to Germany to study the methods of sugar-beet cultivation in that country (1898) Lawes and Gilbert state:—"It is strictly in accordance with the results of our own experiments which have been given, that roots of the desired character could only be produced by restricting the manuring, and by other methods of preventing over luxuriance, and favouring perfect ripening or maturity; in fact, by growing comparatively small roots and small crops per acre. Accordingly, strict rules were issued by the manufacturers to the growers, for the manuring, and for other conditions of growth. One of these was, that if farmyard manure were employed, some other crop, of feeding roots for example, should be taken before a crop was grown for sugar. Then the use of nitrate of soda was practically prohibited, though a small dressing of sulphate of ammonia might be used. The roots were to be grown at a limited distance

between the rows, and between the plants in the rows. In no case was it found that the rows were more than 18 inches apart, and in some cases the distance from plant to plant in the rows was as little as 8 to 9 inches, and seldom more than 10 or 12. In this way, by limitation of the amount of nitrogenous manure, and growing the plants close together, over luxuriance was avoided, and ripe roots, with a high percentage of sugar and low amounts of nitrogenous and saline matters, were obtained."

The conditions thus outlined, however, are by no means generally applicable in England. For example, in the Cambridge experiments conducted in 1905, yields of 18 and 20 tons per acre contained respectively 18·6 and 18 per cent. of sugar in the roots, and the crop was grown on light loamy soil *on ridges 27 inches apart.*

Cultivation.—The cultivation of sugar-beets is similar to that required for mangolds. The soil should be well prepared for the crop, which in general follows a cereal. The stubble should be ploughed to a depth of 10 or 12 inches in October or November, the special objects in view for sugar-beet being to ameliorate the soil, conserve moisture in the subsoil, and destroy weeds. Where such deep ploughing is inadvisable owing to the risk of turning up a poor subsoil, then a subsoiler may follow or be attached to the plough in order to break the land as deeply as possible. The ploughed stubble is now left to the ameliorating influences of the winter frosts, and in spring an endeavour is made to obtain a well-worked mellow seed-bed. Strong loams may need a second ploughing in spring, but generally speaking, cultivating and harrowing will be sufficient to provide a well pulverised seed-bed, and in dry seasons the Crosskill roller will do good service. When possible there should be an interval between the general preparation and the final harrowing in order to encourage weed seeds to germinate, the seedlings being then destroyed before the sugar-beet seed is sown.

The Choice of Seed.—It is of great importance in the case of sugar-beet that the seed sown should be of the best, and of a variety yielding a high percentage of sugar. According to Schribaux, good "seed" (the "seed" of commerce consists of one to three or more true seeds embedded in a woody capsule or fruit) should contain no more than 15 per cent. of

water, and should possess a purity of 97 per cent. Of 100 "seeds" or fruits, 60 at least should germinate within five days, and 80 after fourteen days, while they should furnish about 150 healthy seedlings. The energy or speed of germination is of great importance, quick germination indicating good sound seed.

The standard of the Association of the German Sugar Industry is in the following terms (Knauer and Holirung, 1906):

1. One kilogram (2·2 lb.) of sugar-beet seed must yield at least 70,000 seedlings in 14 days.

2. Of these at least 46,000 must have germinated in 6 days.

3. Of 100 "seeds," or fruits, 75 must have germinated.

4. The water-content is normal up to 15 per cent. inclusive; the seed is saleable up to 17 per cent. inclusive, but from 15 to 17 per cent. the extra weight of water must be made good.

5. Foreign substances are fixed at not over 3 per cent.; seed containing up to 5 per cent. of foreign substances may be sold, but from 3 to 5 per cent. the excess of weight of such foreign matter must be made good.

6. Infraction of only one of the clauses 1—5 renders the seed unsaleable.

7. Differences in testing shall be decided by the average of a new test on the part of the station which made the disputed test, and a test undertaken in the Association's laboratory.

Sowing.—The time of sowing depends upon local climate and soil. In France it varies between the beginning of April and the second week of May, mid-April, perhaps, being about the usual time. In East Prussia seeding seldom begins before the end of May, while in mid-Germany it is usually completed by the middle of May. The seeds are drilled on the flat in the same way as turnips or mangolds, or they may be dibbled in several together at regular distances apart, and about $\frac{3}{4}$ inch deep. The quantity of "seed" used is about 26 to 35 lb. per acre in Germany, and 18 to 26 lb. per acre in France, when drilling is practised, but dibbling requires only about one-third to one-half as much seed, and may therefore prove much less costly. The amount of seed varies with the width between the rows, the period of sowing, the soil and climate, and especially the value of the seed.

The question of spacing has received much attention, but the width between the rows must be sufficient to permit easy hoeing, while the variety grown and the condition of the

soil must also be taken into account. Useful working distances in France are 16 to 18 inches between the rows, and 10 to 12 inches between the sugar-beets when singled in the rows. In Germany the distances vary from 14–18 inches, and 8–12 inches respectively. Though always grown on the flat in Continental countries, sugar-beet might be experimentally grown on ridges 22 inches—24 inches apart in this country, in cases where ridge cultivation appeared to be desirable with the view of gaining deeper soil, more efficient hoeing, and easier harvesting.

Varieties.—Some types of sugar-beet are characterised chiefly by the fact that they yield a high percentage of sugar, *e.g.*, White Silesian, while others are known as heavy croppers containing a medium percentage of sugar, and these appear to be nearly all of French origin. These two types have given rise to numerous varieties differing in form, size, foliage, texture of the "flesh," and sugar content. The following is a list of varieties grown on the Continent for various purposes in different localities:—

French.	*German.*
Blanche à collet rose.	White Silesian Rosetop.
Blanche à collet gris.	White Magdeburg.
Blanche à collet vert.	Imperial.
Bouteuse.	Improved White Imperial.
Blanche Ameliorée Vilmorin.	Improved Rose Imperial.
Française riche	Electoral.
(Fouquier d'Hérouel).	Klein-Wanzlebener.
Simon Legrand.	Schreiber's.
Fl. Desprez.	Mette's.
Demiaulte.	Braune's.
Hary.	
Dennetière.	
Carlier.	
Legras.	
Eloir.	
Laurent-Mouchon.	

Two types might with advantage be grown experimentally in England, the one, represented by Klein-Wanzlebener and Vilmorin's Improved White (Blanche Ameliorée), containing a high percentage of sugar, but yielding only a medium crop; and a second, such as Grey-topped White (Blanche à Collet gris), which yields a large crop, but contains a smaller percentage of sugar.

Klein-Wanzlebener is a type of sugar-beet of which there are a number of sub-varieties, and seems to have originated

from Knauer's Imperial upwards of fifty years ago. It has been much improved in quality until at the present day it is one of the richest in sugar, and is also very productive. The root is tapering, conical, and with rather a wide top, which is sunk almost level with the surface of the soil; for the latter reason this variety is most suitable for deep open soils in a good state of cultivation. The foliage is crisp, abundant, and dull green in colour, the leaves being broad and supported on short stout stalks.

Vilmorin's Improved White is a rather small variety, at times somewhat fibrous rooted, with an abundance of foliage, a broad top, very red skin, and hard compact flesh. It is a fair cropper, but contains a very high percentage of sugar, often 16 to 18 per cent.

Grey-topped White is a variety quite distinct from the two foregoing in several respects. In the first place it is a heavy cropper, and is only about two-thirds buried in the soil, this fact rendering it suitable for the heavier types of soils, where harvesting of deeply-buried varieties would be difficult and costly. Secondly, its sugar content is low, about 7 to 12 per cent. It is rather oval in shape, the skin beneath the soil rosy, and that above grey to bronze towards the top; the foliage is rather erect, and usually fine and light.

It is stated by Knauer and Hollrung that a good variety of sugar-beet should possess the following qualities:—(1) Slender form, lightly drawn in about half-way down, with a moderate length for the whole bulb; (2) Somewhat spirally twisted root grooves (*Wurzelrille*); (3) A small top, not appearing above the surface of the soil, and resembling a truncated cone of about 45 degrees gradient; (4) Short-stemmed leaves, which are not too small, but rather broad, lightly waved, and standing at an angle of about 45 degrees from the bulb; (5) Little susceptibility to conditions leading to "bolting"; (6) Considerable power of retaining the greater part of the non-sugars in the leaves; (7) Exceptional disposition to build up material, especially the separation of sugar.

After-Cultivation.—When the seedlings begin to show well in the rows the horse-hoe should be put to work as in the case of mangolds, and thereafter the more the horse and hand hoes are kept at work the better. Kiehl has shown, indeed,

in Germany that the yield, both of the crop and sugar, increases steadily as the hoeings increase from one to three. Knauer and Hollrung refer to some trials in which from one to five hoeings were given, the times being arranged so that the third hoeing on one plot was given at the same time as the fifth hoeing on another plot. The yields increased with the number of hoeings, as follows:—One hoeing, 6 tons per acre; two hoeings, $7\frac{1}{4}$ tons; three hoeings, $9\frac{1}{2}$ tons; four hoeings, $11\frac{1}{4}$ tons; and five hoeings, $11\frac{3}{4}$ tons.

"Singling" takes place, as with mangolds, six weeks or so after planting, and considerable skill is necessary to do this work with success, more than one seedling appearing from one "seed" or fruit, and it is necessary to remove all but the finest one at the distances apart decided upon without injuring the specimen left. Singling should be done about the time the plants have four leaves, as they then suffer less than if the operation is delayed.

When the crop is well forward and in full growth, as little damage should be done to the foliage as possible, for the leaves constitute the sugar factory of the plant, and if they are removed more leaves must be produced to replace them, and this naturally weakens the plant. The leaves bear an important relation to the production of sugar, and it has been found that the bulbs which are richest in sugar are those which bear the most developed leaf system. The following result is quoted by Déhérain:—

	Ordinary Type.	*Improved.*
Weight of root	3·07 lb.	1·90 lb.
Weight of leaves	0·62 ,,	1·17 ,,
Weight of leaves per 100 of roots ...	20·00	61·00
Sugar per 100 of roots	9·94	14·42

Harvesting the Crop.—Sugar-beets must be harvested when "ripe," that is, when they cease growing, contain the highest percentage of sugar, and are most pure. Such conditions may generally be decided by the appearance of the crop, the leaves becoming yellowish-green in colour, and drooping more or less, some even falling flat on the ground. About three-fourths of the foliage should have wilted, but the central leaves should still be fresh and green. The decision, however, should be made with care, since the appearance described may to some extent follow prolonged

drought, the crop again growing and increasing its sugar content after good rains. The needs of the sugar factories must also be considered, and the earliest crops frequently realise in France 1s. to 2s. per ton more than the later ones. As a rule harvesting is commenced towards the end of September or at latest the first week in October. Not only is it necessary to harvest before frosts occur, but in time for the sowing of the wheat crop to be put in hand. In order to meet the various requirements it is found useful to sow different varieties of sugar-beet possessing unequal powers of growth and ripening.

The crop may be lifted by hand labour with the aid of a special spade or two-tined fork, according to the soil and variety of sugar-beet grown. On the Continent this method is chiefly followed, but special horse implements lifting one or three rows at a time are also used, while another type of machine lifts, tops, and cleans the sugar-beets, depositing them in a row on one side. Lifting must be carefully done so that the skin is not broken, or loss of sugar will occur. Topping must also be carefully carried out; if the tops are removed too deeply the grower will lose weight in delivering to the factory, while if too shallow the tare deductions at the factory will be increased. For a similar reason sugar-beets should be delivered as clean as possible. The tops should be removed at the point whence the lowest leaves spring.

Yield.—As in the case of other farm crops, the yield of sugar-beets varies with soil, manuring, general treatment, and local climatic conditions. In France the average yield is perhaps 12 to 14 tons per acre with good growers, or in dry seasons it may be difficult to realise 11 to 12 tons. In exceptional situations and favourable years up to 16 tons may be grown, but such a yield is only obtained on rich deep soils. The average yield for France during the ten years 1897–1906 is quoted by Malpeaux as 10·3 tons per acre. The average yield for 1905 is given as 11·2 tons per acre, and the average value as 18s. 7d. per ton. According to Mentzel and Von Lengerke the yield in Germany varies from 9½ to 16 tons, and is exceptionally about 20 tons per acre.

As regards Great Britain, yields have varied widely. At five centres in Essex in 1905 the average yield was 18·3 tons

per acre, with a sugar content of 16·7 per cent. The results of 21 trials in Suffolk in 1906 gave an average yield of 14 tons 17 cwt. per acre, with a sugar content of 16·21 per cent. In these trials four cases showed yields of 14 tons, 18 tons, 18 tons 15 cwt., and 20 tons 2 cwt., with sugar content of 19·4 per cent., 19·65 per cent., 17·23 per cent., and 16·16 per cent. respectively.

Experiments conducted by the Cambridge University Department of Agriculture in 1905 and 1906 showed the following results:—

	Yield		Sugar in root.
	Tons.	Cwt.	(Per cent.)
Offord D'Arcy, 1905 (average of four varieties) ...	18	15	16·67
Ramsey, 1906 (,, ,, two ,,) ...	23	0	11·65
Outwell, 1906 (,, ,, two ,,) ...	16	10	16·25
Histon, 1905 (average of eight manurial trials in duplicate)	17	3	17·60
Histon, 1906 (average of six manurial trials in duplicate)	18	1	16·86

Cost per Acre.—In so far as the cost of growing and harvesting an acre of sugar-beets is concerned, a good deal depends on the soil and local conditions, and there are considerable differences between farms in the same district. According to data given by the agricultural school (*comice*) at Laon, the net cost of an acre may be estimated as:—

	£	s.	d.
Rent, rates	1	5	11
Supervision		1	4
Dung and manures ...	4	15	3
Seed and sowing		14	7
Cultivations, &c.	1	19	2
Cartage of sugar-beets ...	1	4	4
Lavour—various	1	19	11
	£12	0	6

This figure, however, is often surpassed in France.

According to Geschwind the cost of growing an acre in 1900 amounted to:—

	£	s.	d.
Rates, taxes, &c.	1	12	5
Various cultivation ...	1	12	5
Manuring	4	1	0
Seed 2*s.* 6*d.*, Sowing 12*s.* 2*d.*		14	8
Hoeings, singling, &c. ...	1	10	9
Carting		19	5
Interest, sinking fund, &c.	1	1	3
Total	£11	11	11
Less value of leaves ...		14	7
Final cost	£10	17	4

In the neighbourhood of Halle the cost per acre has been estimated at:—

	£	s.	d.
Autumn cultivation ...		19	1
Spring cultivations ...		19	1
Seed		11	4
Sowing		4	0
Singling		3	3
2 Hand hoeings		7	11
4 Horse hoeings		3	2
Lifting and storing ...		19	1
Carting, transport, &c. ...	1	14	3
Rent, taxes, &c.	2	17	1
Manures	5	3	6
	£14	1	9

In other cases in Germany the cost has been estimated as:—

	Per acre. £	s.	d.
Near Breslau	9	17	4
West Prussia	12	10	0
Hanover	10	18	0
Brunswick	14	5	6

On 98 sugar-beet farms the cost of producing a ton of sugar-beet in Germany between the years 1893 and 1898 amounted in round figures to:—

		s. d. s. d.
On	3 Farms	12 6–14 6
,,	4 ,,	14 6–16 6
,,	15 ,,	16 6–18 6
,,	25 ,,	18 6–20 6
,,	22 ,,	20 6–22 6
,,	9 ,,	22 6–24 6
,,	9 ,,	24 6–26 6
,,	5 ,,	26 6–28 6
,,	4 ,,	28 6–30 6
,,	1 ,,	30 6–32 6
,,	2 ,,	32 6–34 6

On most of the farms included in the figures it will be observed that the cost of producing a ton of the sugar-beets lay between 16s. 6d. and 22s. 6d.

As regards England it may be said that experiments conducted in Essex at several centres in 1905 showed that the total cost of growing an acre of sugar-beets was as follows:—

	£	s.	d.
Maplestead	9	3	0
Great Yeldham	11	3	1
St. Osyth	11	4	10
Great Stambridge	11	17	6
Chelmsford	13	8	0
Average	£11	7	3

A representative cost was at Great Yeldham, where the items of expense are quoted as follows:—

	£	s.	d.
Steam cultivated in autumn		16	0
Sized on ridge		4	0
Farmyard manure, 20 loads	3	10	0
Labour on same	1	0	9
Four furrowed		8	0
Harrowing twice		1	4
Drilling seed		1	0
Labour, sowing manure ...		1	0
Rolling			6
Hoeing, 4 times at 5*s*. ...	1	0	0
Horse-hoeing, 3 times ...		4	6
Raising and clamping ...	2	10	0
Artificial manure	1	6	0
	£11	3	1

At this centre the yield varied with the variety, and the application or otherwise of potash, between 15·6 tons and 25·1 tons per acre.

As a result of experiments conducted in Suffolk in 1906 the cost per acre at two centres is given as £8 4*s*. 8*d*. and £10 7*s*. 6*d*. In the former case the yield amounted to 14 tons per acre, containing 19·4 per cent. of sugar in the roots, and in the second case the yield was 18 tons per acre, containing 19·65 per cent. of sugar.

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FRUIT FARMING IN WEST KENT.

CECIL H. HOOPER, M.R.A.C.

The plantations in Crockenhill parish in West Kent, where several thousand acres are under apple, plum, and pear, afford good examples of planting and management. This parish 60 years ago was largely woodland. The pioneers in fruit growing commenced to grub the woods, the landowner giving the underwood for the work of grubbing (worth £8 or £10 per acre), but retaining the oak timber for himself. For one year after grubbing the land was free of rent, and afterward £1 per acre was charged. Crops generally grow well after woodland, and for some five years no manure was required, strawberries and raspberries being found to thrive particularly well. In these pioneer days there were about 100 inhabitants in the parish, and during winter the men chiefly worked in the barns threshing or in the woods cutting underwood. At present there are nearly 2,000 inhabitants, of whom the greater part are more or less engaged in fruit cultivation or picking. Wages were formerly 10–15*s*. per week, but now range from 18 to 20*s*., and in the case of piece-work up to 24*s*. The rent of the land has risen to 30*s*. or 40*s*. per acre.

APPLE PLANTATIONS.

Cultivation and Planting.—In Crockenhill there are many plantations of half standard trees, but the more recent plantations are almost entirely bush-trees, most of the apples being grafted on the broad-leaved English Paradise stock. The land on which the plantations are being made was largely market garden land, which had for years been liberally manured.

Bush apple plantations are generally set out 10 ft. × 10 ft. or 12 ft. × 12 ft., chiefly on the square, though some are planted in triangles. Sometimes a strong grower like Bramley's Seedling is planted alternately with a weaker grower such as Lane's Prince Albert. Among the apples found to answer best for this method of planting in West Kent are Graham's Royal Jubilee, Newton Wonder, Lord Derby, Duchess' Favourite, Lord Suffield, King of the Pippins, Worcester Pearmain, Beauty of Bath, Bramley's Seedling,

Lane's Prince Albert, Early Victoria, Rivers' Early, Prince Bismarck, White Transparent, Baumann's Red Winter Reinette, and Gladstone. Under favourable conditions Beauty of Bath grows to such a big bush as to require 15 ft., so that if planted alone more space is required.

For the first five or six years strawberries may be grown between the apples, four rows of strawberries being planted if the bush apples are 10 feet apart; sometimes 3 rows of harvest onions are grown for the first year between the rows of strawberries.

The following is an estimate of the cost of manuring and cultivating the land preparatory to planting fruit:—

PREPARATION OF LAND FOR FRUIT PLANTING.

Manuring.

	£	s.	d.
40 tons stable or cow manure at 4*s.* 3*d.* per ton	8	10	0
Cartage from station and depositing in heaps at 2*s.* 4*d.* per ton ...	4	13	4
Spreading	0	3	4
	£13	6	8

Preparation with Steam Cultivator.

	£	s.	d.
Ploughing	0	15	0
Steam cultivation by grubber twice over, crossways, 18 in. deep	1	0	0
Coal (2*s.*) and cartage of coal and water (1*s.*)	0	3	0
Harrowing three or four times	0	5	0
	£2	3	0

(or) *Preparation with Subsoil Plough.*

	£	s.	d.
Ploughing, say, 7 ins. deep (3 horses)	0	18	0
Followed by a subsoil plough or heavy horse hoe (2 horses), stirring the ground 5 ins. deeper	0	12	0
Harrowing	0	3	0
	£1	13	0

Total Cost of Cultivating and Planting per Acre.

	£	s.	d.
Manuring with 40 tons stable manure	13	6	8
Ploughing, subsoiling, harrowing, weeding	2	10	0
Setting out land by marker or by sighting	0	15	0
Digging holes and planting (10 ft. apart)	1	18	0
436 apple, pear or plum bushes (2 or 3 years' old) at £6 per 100*	26	3	1
Strawberry plants, and planting four rows between apple rows 32 in. apart, 18 in. in row	5	0	0
	£49	12	9

* If the distance between the apple trees is 12 ft., 303 trees are required costing say, £18 3*s.* 7*d.*, and £1 6*s.* 5*d.* to plant. At this distance there would be five rows of strawberries, one row being in the apple row.

Small Fruit planted between the Rows.—Many plantations are planted with black currants between the bush apples or pears. Great care is taken to get stock free from the Big Bud mite, but as this usually attacks the fruit within four or five years, the bushes are planted more closely than formerly,

namely, 5 ft. × 2½ ft. They are well cultivated and manured to make them grow strongly so as to yield well, and after about six years are grubbed up. In a good season black currants will yield 1¼ tons per acre, and the price per ton is good, as they are rather scarce. To plant black currants 2½ ft. apart, with three plants between each bush apple, costs about £10 per acre additional, allowing *7s. 6d.* per 100 for the black currants. Red currants and gooseberries are usually planted alone, though some mixed plantations include them.

The varieties at present found best suited to West Kent are for black currant, Baldwin and Boskoop; for red currant, Raby Castle; for gooseberry, Lancashire Lad, Whinham's Industry; for raspberry, Superlative and Hornet; for strawberry, Royal Sovereign and Laxton.

Pruning.—The bush apples are summer pruned, keeping the trees somewhat open in the middle and cup-shaped. The branches are pruned like a cordon, the lateral shoots being cut off at about four inches from the stem, the leading shoot being left untouched to be shortened in the winter pruning.

Protection against Insect and Fungus Pests.—Trees are grease-banded about October, and when the bands are taken off in spring the trunks are lime-washed, to counteract any damage by grease running down the stem. For winter spraying of the bush and other trees either lime and salt spray or caustic alkali spray is used about February. In using the caustic alkali and lime sprays vaseline is provided for the men to put on their hands and faces before commencing work. If the trees have been attacked by apple scab or other fungus disease, they are sprayed during the winter with copper sulphate. For spring and summer spraying paraffin emulsion, made with sulphate of iron, and the Woburn Bordeaux mixture paste have been used.

Manuring.—As a general manure the following quantities are used for apples when in bearing: 3 cwt. superphosphate, 1 cwt. sulphate of ammonia, and either 2 cwt. kainit or 1 cwt. of either sulphate of potash or muriate of potash; or as an alternative 7 cwt. bone and meat meal and 1 cwt. sulphate of potash.

Yield.—The yield from a plantation of bush apples, say, eight years old and after, is considered good if it averages one bushel per tree. Bramley's Seedling half standard on

crab or free stock, 20 years old, on good soil, sometimes yields eight or nine bushels, but the trees need to be nearly 30 feet apart.

Packing.—Apples are packed early in the season in pecks, later in half-bushel and bushel *baskets* lined with blue paper, covered with green lucerne, with two cross-splints to keep them firm.

PEAR, PLUM, AND CHERRY PLANTATIONS.

There are several plantations entirely of pears planted about 10 feet square, and the following varieties are popular:—Fertility, Hessle, Catillac, Conference, Souvenir du Congrès, and Jargonelle. In many plantations a row of pears is planted each side of the roadway. Hessle and Fertility are used for this purpose.

Some plum plantations have been made with bush trees branching close to the ground, and planted with strawberries. The latter are grubbed up after, say, six years, and then the cultivation consists, as with the bush apples and pears, in digging by fork during winter, horse hoeing when necessary, and hand hoeing about four times during the season. Victoria, Monarch, Heron, and Early Rivers are favourite varieties.

In West Kent but few cherries are grown, though there are one or two plantations of Morello cherries, and the following was approximately the cost of planting in one case:—

Cost per Acre of Planting Bush Morello Cherries at Swanley.

	£	s.	d.
Ploughing, subsoiling, harrowing	1	13	0
Weeding	0	7	0
Setting out	0	15	0
5 cwts. bone meal at 5s., put in holes	1	5	0
135 two-year-old trees at 135s. per 100, at 18 ft. apart...	9	2	3
1,075 red currants at 7s. 6d. per 100, at 6 ft. apart ...	4	0	7
Planting trees and bushes	2	0	0
Strawberries planted between 36 in. by 18 in.	5	0	0
Cartage, &c.		17	2
	£25	0	0

When this plantation was about 14 years old, the sale of the cherries and currants together realised £60 gross per acre, but it was in a very favourable season.

The best cherries are grown in the neighbourhood of Sittingbourne, Faversham, and Sheldwich; the soil is on loam over clay on chalk. They are found to thrive best when

planted on arable land, which is kept cultivated for, say, ten years, for which reason they are often planted among hops. After about ten years the land is sown with grass seeds and stocked with sheep, which receive corn or cake as additional food. Among the best varieties grown in these Kentish orchards may be mentioned Early Rivers, Early Black, Waterloo, Old Black Heart, Black Eagle, Bigarreau or Amber, Bigarreau Napoléon, Frogmore Bigarreau, and Turk.

Mr. Walter Kruse, who planted fruit extensively in mid-Kent, gave me the following as the approximate cost per acre of forming a mixed plantation of apple and plum trees with gooseberries :—

		£	*s.*	*d.*
Cultivating and cleaning land £2 to £4		3	0	0
Manuring from £1 to £10		4	0	0
Setting out plantation 12 ft. apart for trees, 6 ft. by 3 ft. for bushes		0	10	0
305 apple and plum trees at 1*s.* each	£15 5 0			
2,115 gooseberries at 12*s.* per 100	12 14 0			
2,420		27	19	0
Digging holes and planting trees at 8*s.* per 100, £1 4*s.* 6*d.*; stakes and staking at 2*d.* each, £2 10*s.* 10*d.*	£3 15 4			
Digging holes and planting gooseberries at 5*s.* per 100	5 5 9			
		9	1	1
Rent, rates, cultivation, including digging docks, couch, etc., by hand, pruning, and general cultivation of plantation, washing, re-tying trees, share of foreman's time, finding men when cultivation cannot be done—for three years at £10 a year ...		30	0	0
Replacing dead trees and bushes		0	12	0
Share of fencing and packing lodge	£5 0 0			
Share of roads	1 0 0			
		6	0	0
Interest on capital £66 at 5 per cent. = £3 6*s.* per annum for three years		9	18	0
		£91	0	1

In such a plantation the trees are planted about 12 feet apart, sorts that crop well and do not grow much being put between the larger growing sorts. Gooseberries and currants are planted 6 feet by 3 feet, and remain from seven to ten years.

On the same farm 28 acres of fruit were planted in 1888; after deducting the amount of fruit, potatoes, etc., sold in the first two years, the cost was found to be £2,070. Besides this there was an outlay of £90 for fencing, and £140 for buildings, etc., together with the loss on cultivation until the fruit paid expenses, making a total of about £2,888, or fully £100 per acre.

IMPORTS OF AGRICULTURAL PRODUCE IN 1910.

The total value of the principle articles of food imported into the United Kingdom in 1910 was £189,433,000, as against £191,505,000 in 1909, £183,957,000 in 1908, £188,353,000 in 1907, £181,604,000 in 1906, and an average of £177,047,000 in the three years 1903–1905. These figures represent the value (cost, insurance, and freight), as declared to the Customs officers at the port of arrival, of the grain and flour, meat and animals for food, butter, cheese, eggs, condensed milk, fruit and vegetables, hops, lard, and margarine, which may be grouped together as agricultural food products in the sense that they compete more or less directly with the home supply.

The decrease in value during the past year as compared with 1909 was due to the diminished cost, on the whole, of the grain and grain products imported, the total value of the items included under this general heading amounting to only £77,298,000, as compared with £83,107,000 in 1909. On the other hand, the value of meat (of all kinds) and of butter, though not exceptional, was higher than in the preceding year.

Cattle and Beef.—The past year has seen a further decline in the number of live cattle imported into the United Kingdom, the number received being less than in any year since 1877. Only two countries (apart from the Channel Islands) participate in this trade, viz., the United States and Canada, and the diminution in the export is no doubt attributable to the increased demand for cattle in the United States.

The decline in this direction was more than compensated for by the extensive imports of beef, chiefly chilled and frozen, which amounted in the aggregate to 7,015,000 cwt., the highest figure yet recorded. The main source of supply is Argentina, from which country 2,711,000 cwt. of chilled beef, and 2,188,000 cwt. of frozen beef were received. A noticeable feature here is the extension of the chilled beef trade (representing the better class of meat), which increased to the above figure from 1,827,000 cwt. in the preceding year, whereas the frozen beef imports showed some decline. The chilled beef averaged 36*s.* 6*d.* per cwt., while the frozen beef was several shillings lower, viz., 30*s.* 3*d.* per cwt. The

receipts of chilled beef from the United States, like those of live cattle, were small (469,000 cwt.), but on the other hand, there was a substantial increase of frozen beef from Australia and New Zealand.

The weight of beef represented by the imports of cattle may be estimated at 1,417,000 cwt., which, added to the imports of fresh and refrigerated beef, make the total receipts of meat of this class from abroad in 1910 8,432,000 cwt., or about $20\frac{3}{4}$ lb. per head of the population. In 1909 the figures were 8,217,000 cwt., representing $20\frac{4}{9}$ lb. per head; in 1908, 8,115,000 cwt., or $20\frac{2}{5}$ lb. per head; in 1907, 8,806,000 cwt., or $22\frac{1}{3}$ lb. per head; and in 1906 9,170,000 cwt., which was equal to $23\frac{1}{2}$ lb. per head.

Sheep and Mutton.—Only 427 live sheep were imported, but the quantity of mutton showed a substantial increase. Nearly all of it comes in the form of frozen mutton, chiefly from New Zealand (2,104,000 cwt.), Australia (1,525,000 cwt.), and Argentina (1,420,000 cwt.). The quantity received from Australia showed a considerable growth over the preceding year, when the amount was only 944,000 cwt.

The weight of meat represented by the sheep received alive would only be 252 cwt., so that the imports of fresh and refrigerated mutton, viz., 5,406,000 cwt., may be said to represent the whole supply apart from home produce, and this is equal to $13\frac{1}{3}$ lb. per head of the population. In the two previous years the total receipts, alive and dead, were 4,766,000 cwt. and 4,434,000 cwt. respectively, or about 12 lb. and 11 lb. per head of the population.

The receipts of fresh and refrigerated mutton in the past year were the largest on record, exceeding by nearly 650,000 cwt. the total for 1909, so that, notwithstanding the falling-off in the supply of live sheep, the total quantity of mutton imported from abroad was larger than in any previous year.

Rabbits.—The receipts of fresh rabbits, chiefly from Belgium, amounted to only 60,400 cwt., and the bulk of the supply was composed of frozen rabbits from Australia and New Zealand, the former country sending 513,000 cwt. and the latter 90,000 cwt. The value per cwt. of these frozen rabbits was, however, only about one-third of the value per cwt. of the fresh Continental supply.

IMPORTS of Live and Dead Meat.

Description.	Quantity.		Value.	
	1909.	1910.	1909.	1910.
	Number.	Number.	£	£
Cattle	321,340	219,561	5,566,105	4,027,918
Sheep	8,131	427	12,923	754
Total live animals ...	—	—	5,579,028	4.028,672
	Cwt.	Cwt.		
Beef, fresh & refrigerated	6,140,522	7,015,498	10,293,406	11,745,222
,, salted	110,015	87,636	196,238	173,924
Mutton, fresh and refrigerated	4,761,838	5,406,026	7,839,195	9,803,004
Pork, fresh & refrigerated	428,444	479,907	1,023,322	1,196,797
,, salted	258,539	227,191	312,862	304,168
Bacon	4,625,463	3,863,389	13,801,665	13,391,274
Hams	1,129,029	719,126	3,112,896	2,526,585
Meat unenumerated—				
Fresh and refrigerated ...	698,801	707,113	1,276,009	1,310,739
Salted	55,601	70,541	98,645	102,573
Meat, preserved	609,984	742,834	2,333,413	2,514,063
Rabbits, dead	579,856	664,190	727,954	837,122
Total dead meat ...	19,398,092	19,983,451	41,015,605	43,905,471
Poultry and game ...	—	—	1,028,795	944,922

Bacon.—The decline in the importation of bacon which was noticeable in 1909 continued in 1910, and the imports were lower than in any year since 1894. The falling off was chiefly confined to the United States and Canada, the former country only sending 1,307,000 cwt. as compared with 2,858,000 cwt. in 1908, and the latter 412,000 cwt. as against 688,000 cwt. There was also some decline in the exports from Denmark, which only sent 1,794,000 cwt. as compared with 2,050,000 cwt. in 1908.

The declared average value was 69*s.* 4*d.* per cwt. as compared with 59*s.* 8*d.* in 1909 and 50*s.* 11*d.* in 1908. It thus exceeded the highest figure recorded in the last forty years, viz., 62*s.* 10*d.* per cwt. in 1870.

Poultry and Game.—Poultry is chiefly received from Russia, United States, France, and Austria, and the total value in 1910 was £821,000, a somewhat substantial drop from the total of the preceding year (£921,000). The value of the imported game was £124,000.

Total Imports of Meat.—Converting the live animals into their equivalent weight of meat and adding the total imports of dead meat of all kinds (excluding poultry and game), it appears that the quantity available, in addition to the home supply, was some 21,401,000 cwt., as compared with 21,479,000 cwt. in 1909, 22,205,000 cwt. in 1908, and 22,586,600 cwt. in 1907. This was not entirely consumed in this country as there was a small re-export amounting to 220,000 cwt.

The total value credited to the different kinds of live and dead meat, including poultry and game, was £48,879,000, as compared with £47,623,000 in 1909, £49,448,000 in 1908, £51,888,000 in 1907, and £52,026,000 in 1906.

IMPORTS of Dairy Produce, Margarine, and Eggs.

Description.	Quantity.		Value.	
	1909.	1910.	1909.	1910.
	Cwt.	Cwt.	£	£
Butter	4,062,812	4,325,539	22,424,962	24,493,450
Margarine	868,292	1,120,616	2,243,737	2,935,244
Cheese	2,390,090	2,456,351	6,829,863	6,809,854
Milk, condensed ...	991,378	1,009,476	1,731,776	1,755,070
	Great hundreds.	Great hundreds.		
Eggs	17,710,431	18,344,137	7,233,932	7,296,145

Butter.—About three-fourths of the butter supplied to this country from abroad comes from the Continent of Europe, Denmark (1,726,000 cwt.), Russia (584,000 cwt.), France (361,000 cwt.), Sweden (346,000 cwt.), and Holland (155,000 cwt.), being the chief contributors. Almost the whole of the remainder is received from Australia (639,100 cwt.) and New Zealand (363,000 cwt.).

The quantity of butter received was nearly as large as in 1906, when the maximum amount yet recorded was imported; the value, however, in 1910 was 113*s.* 3*d.* per cwt., as compared with 108*s.* 2*d.* in 1906, so that the total value of the foreign and colonial butter imported in the past year was exceptionally high.

Cheese.—The supply of cheese showed a small increase, Canada maintaining its position as the principal exporter.

An increase is noticeable in the receipts from New Zealand, while those from the United States have now become of little importance.

Eggs.—Up to 1909 the supply of eggs had been declining for several years, but in 1910 the exports from Russia showed a somewhat marked increase, and brought the total above that of the past two years.

IMPORTS of Grain and Flour.

Description.	Quantity.		Value.	
	1909.	1910.	1909.	1910.
	Cwt.	Cwt.	£	£
Wheat	97,854,425	105,222,638	45,272,131	44,160,884
,, meal and flour ...	11,052,540	9,960,491	6,370,480	5,510,905
Barley	21,556,470	18,281,300	7,143,849	5,396,676
Oats	17,835,998	17,494,814	5,437,857	4,823,641
Oatmeal	583,125	775,033	465,118	582,225
Maize	39,362,605	37,021,192	12,122,812	10,294,346
,, meal	334,140	461,624	127,751	158,953
Peas	1,314,149	1,591,111	603,054	718,740
Beans	2,171,230	849,202	757,600	311,734
Other corn and meal ...	12,135,950	13,968,172	4,806,769	5,340,261
Total	204,200,632	205,625,577	83,107,421	77,298,365

Grain and Meal.—The imports of wheat exceeded in quantity but not in value, those of any previous twelve months. The increase in quantity was somewhat remarkable, representing as it did a rise of more than 7,000,000 cwt. above the figure of 1909, which was itself the maximum yet recorded. The value, on the other hand, was about £1,100,000 less than that of 1909. The leading sources of supply were Russia (28,942,000 cwt.), India (17,917,000 cwt.), Canada (16,449,000 cwt.), Argentina (15,132,000 cwt.), United States (10,949,000 cwt.), while Australia and New Zealand together accounted for 13,748,000 cwt. This is the largest importation in any one year which has yet been made from these Colonies.

The receipts of flour were less than in 1909 owing to a further falling off from the United States.

Barley showed a decrease as compared with the previous year. The principal contributors were Russia (9,234,000 cwt.), Turkey (1,464,000 cwt.), Roumania (2,901,000 cwt.), and the United States (2,112,000 cwt.).

Oats amounting to 17,495,000 cwt. were imported in 1910, or approximately the same figures as in 1909. Russia (8,100,000 cwt.) and probably Argentina were the two chief sources of supply. Argentina has assumed a position of some importance in this trade, but is still included among "other countries" (unspecified), the import from which amounted to 5,067,000 cwt. Germany furnished 2,822,000 cwt., while the imports from the United States were insignificant.

The supply of maize (37,021,000 cwt.) continued small, Argentina, Russia, and the United States all furnishing diminished quantities compared with 1909. The imports for the past three years have been decidedly below those of the previous twelve years.

Fruit and Vegetables.—Potatoes were received in smaller quantities than has been the case for many years past. The exports of early potatoes from the Channel Islands were unaffected, but the receipts from Germany in 1909 and 1910 were only 21,000 and 34,500 cwt. respectively, as compared with 674,000 cwt. in 1908. The imports from France were also small.

With regard to fresh fruit, there was a marked falling off in the imports of apricots and peaches, cherries, currants, and to some extent in those of other fresh fruit, such as pears, plums, and strawberries. There was, however, a good supply of apples.

Hops were imported to the extent of 177,000 cwt., as against 141,000 in 1909, but at a very much higher price.

Wool.—As regards wool the quantity imported differed but slightly from that of the previous year, but the average price rose from $9\frac{1}{2}d.$ to $10\frac{1}{4}d.$, which was the level at which it stood in 1906 and 1907. The bulk of the supply came, as usual, from our own Colonies and Possessions, viz., Australia (314,517,000 lb.), New Zealand (189,681,000 lb.), British South Africa (104,297,000 lb.), and India (53,334,000 lb.). The total receipts were 798,572,000 lb., as compared with 803,433,000 lb. in 1909.

The re-exports of foreign and Colonial wool were 334,643,000 lb., as against 390,107,000 lb. in 1909, so that the balance of wool (other than home produce) remaining

for manufacture in this country was 463,929,000 lb., which was a larger amount than in the three preceding years, viz., 413,326,000 lb. in 1909, 393,594,000 lb. in 1908, and 446,564,000 lb. in 1907.

Soya Beans.—The imports of this article, the residue from which in the form of cake has assumed such importance as a feeding stuff, are separately recorded this year for the first time. The total received was 421,531 tons, of which 96,981 tons came from Russia, 174,415 tons from China, 149,958 tons from Japan. The aggregate value was £3,047,000, and the average value per ton about £7 4*s*. 7*d*.

Prices.—Some indication of the range of prices may be gathered from the average declared value of the different articles, but only to an approximate extent, as an increased importation of a cheaper quality of any article depresses the average value, although no real change in price may have taken place. With this reservation it may be said that the record for the past year shows, on the whole, an increase in the value of meat, but some decline in the values of grain and flour. Fresh beef was stationary, but mutton, pork, bacon, and hams were noticeably higher. Butter showed a small rise, but cheese, eggs, wheat, wheat-flour, barley, oats, and maize appeared to be valued at a lower figure than that of 1909. The figures for some of the principal articles are as follows:—

Description.		1907.			1908.			1909.			1910.		
		£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*
Cattle	Head	17	3	5	17	1	11	17	6	5	18	6	11
Sheep	,,	1	11	11	1	11	1	1	11	10	1	15	4
Beef, fresh & refrigerated	Cwt.	1	16	3	1	16	7	1	13	6	1	13	6
Mutton, ,, ,,	,,	1	17	11	1	17	1	1	12	11	1	16	3
Pork, ,, ,,	,,	2	7	2	2	6	6	2	7	10	2	9	11
Bacon	,,	2	15	4	2	10	11	2	19	8	3	9	4
Hams	,,	2	17	3	2	10	4	2	15	2	3	10	3
Butter	,,	5	6	6	5	14	4	5	10	5	5	13	3
Cheese	,,	2	18	3	2	18	0	2	17	2	2	15	5
Eggs ...	Great hundred	0	7	$8\frac{1}{4}$	0	7	$10\frac{3}{4}$	0	8	2	0	7	$11\frac{1}{2}$
Wool	Lb.	0	0	$10\frac{1}{4}$	0	0	$9\frac{1}{4}$	0	0	$9\frac{1}{2}$	0	0	$10\frac{1}{4}$
Wheat	Cwt.	0	7	8	0	8	$4\frac{3}{4}$	0	9	3	0	8	$4\frac{3}{4}$
,, flour	,,	0	10	1	0	10	11	0	11	$6\frac{1}{4}$	0	11	$0\frac{3}{4}$
Barley	,,	0	6	8	0	6	$9\frac{1}{4}$	0	6	$7\frac{1}{2}$	0	5	$10\frac{3}{4}$
Oats	,,	0	6	5	0	5	10	0	6	$1\frac{1}{4}$	0	5	$6\frac{1}{4}$
Maize	,,	0	5	6	0	6	$1\frac{3}{4}$	0	6	2	0	5	$6\frac{3}{4}$

APHIDES, OR PLANT LICE.*

NEARLY all plants, both in garden and field, and under glass, suffer from the ravages of Aphides. These universal pests are most common in temperate climates, but even in the tropics whole crops are ruined by them. Aphides are known by a variety of common names, such as Plant-Lice, Green or Black Fly, Smotherers, or Dolphins, while the disease they cause is sometimes termed "Blight."

Aphides are soft-skinned insects with antennæ generally longer than the body. When wings are present they are delicate, and have few veins. On the upper surface of the abdomen two tubes are generally present—sometimes short, sometimes long—from which a liquid can be discharged. The mouth parts are fitted for piercing and sucking; the plant tissues are first pierced and then the sap is drawn away. The skin of plant-lice is provided with glands which secrete a waxy or mealy substance or woolly masses which have the power of throwing off water.

The young differ little in form from the full-grown insects, and their feeding habits are the same.

Development from the young stage to adult takes a very short time, and hence multiplication of individuals is rapid. Dry, hot weather is specially favourable for Aphides.

The summer generations of Aphides are produced without the presence of males, and the females may be wingless or winged, both conditions being found in the same life-history. The winged generations spread the infestation. These females—wingless and winged alike—can give rise to live young, and this power of viviparous multiplication and the appearance of winged forms are to be associated with abundance of food at certain times of the year. As the cold part of the year comes males as well as females are produced and fertilised eggs are laid.

Some Aphides confine themselves to one species of plant; others migrate so that part of the life-cycle is spent on a plant of a different species. Migration of the same kind of Aphid

* Various species of Aphis are dealt with in Leaflets issued by the Board, copies of which can be obtained on application, viz.: Woolly Aphis (Leaflet 34), Currant Aphides (Leaflet 68), Hop Aphis (Leaflet 88) and Aphides or Plant Lice (Leaflet 104).

may take place to a number of quite unrelated species of plants.

Aphides damage plants in two ways: (1) by sucking away the sap and so weakening the plant, and (2) by their excrement falling on the leaves and clogging the stomata and so interfering with gaseous interchange. Further, the excrement, consisting partly of a sweet gummy substance called "honey-dew," is a favourable germinating medium for the spores of some fungi, and spoiled sooty-coloured patches show on twig, leaf, and fruit.

Natural Checks.—Several insects prey upon Aphides, and should be encouraged. The chief of these are Ladybirds and their larvæ (*Coccinellidæ*); Hover-fly larvæ (*Syrphidæ*); and the larvæ of the Lace-wing Flies (*Chrysopidæ*). Various minute Hymenopterous parasites (*Chalcididæ*) lay their eggs in the bodies of Aphides, those parasitised being destroyed. Man cannot, however, rely solely on the services of these beneficial insects, but should check the increase of the Aphides by washes as soon as they appear upon his plants.

THE BEAN APHIS (*Aphis rumicis*, Linn.).—This Aphis, known variously as Black Fly, Collier, and Black Dolphin, is in some years a very severe enemy of the Bean Crop, shoots and pods being quite smothered with the insects. Harm results not only from the weakening of the plant by the draining away of the sap, but also from the masses of excrement which cover and clog the outside of the plant. Important points in the biology of this Aphis are: (1) It does not confine itself to the Bean Crop, but is found on many other plants in widely separated Natural Orders, examples being docks, thistles, furze; (2) There are regular migrations to these plants and back to the bean again; and (3) Various generations with somewhat dissimilar individuals are found at different stages in the life-history. The following are recognisable:—(*a*) The early wingless female, on the bean, black in colour with ochreous tints on the shanks and the middle joints of the antennæ. This female produces live young; the young are slate-grey to black. At certain times a stage is found when the insects show dusky wing-cases or wing rudiments, and the abdomen is black, with white spots; this is the stage

preceding (*b*) the winged females. These winged females are black or black with a brownish tinge; the shanks and middle joints of the antennæ are yellowish; the wings are yellow at the base, greenish in front, and have brown veins. These females produce live young. (*c*) Wingless females found in autumn and resembling the females of (*a*); the females of (*c*) lay eggs. (*d*) Males, appearing late in the season; they have wings, and are black or black-brown in colour.

Life-History.—The wingless females of the early part of the year are found on the bean tops, and give rise to live young. Multiplication is rapid, and ultimately winged females appear which spread the infestation to other beans and to different food plants. In the autumn, with the appearance of the males and egg-laying females, fertilised eggs are laid on the plants to which the Aphides have migrated.

Treatment.—(1) The infested tops should be cut off and burnt. This should be done early. (2) The beans should be sprayed with soft-soap and quassia. Dissolve 5lb. of soft-soap in 100 gallons of soft water; boil 6 to 8lb. of quassia chips, and add the extract to the 100 gallons of wash.

THE CABBAGE APHIS (*Aphis brassicæ*, Linn.).—In the case of this species, infested leaves drained of their sap become yellow and bleached. Blistered patches show, and under these the Aphides are found. As the numbers increase the pests are found both on the upper and lower surfaces of the leaves.

The wingless viviparous females have their bodies covered with a mealy secretion that gives them a white appearance and masks the grey-green colour of the body; dark spots are present on the upper surface; the antennæ are green or yellow-green with dark tips; legs and eyes are dark-brown or brown-black; the cornicles or tubes on the back are short and dark-brown; the young, until the mealy secretion appears, are bright yellow or yellow-green.

When the mealy secretion is removed the winged viviparous females are seen to have the front part of the body black, and the hind part yellow-green; legs and cornicles are dark-brown.

The males are green with black antennæ, and the cornicles are dark at the base.

The egg-laying female is green, with rows of dark spots on the back; the eggs are green at first, but later are black.

Life-History.—Young Aphides hatch from eggs laid in the previous autumn on cruciferous plants (both wild and cultivated). During the summer the wingless and winged virgin females are found. The winged females spread the infection. Both the wingless and the winged females produce live young. Towards the end of the season, when infestation is worst, males and wingless egg-laying females pair, and fertilised eggs are laid from which in the next year come the individuals which start the colonies for the year.

Treatment.—(1) Cruciferous weeds should be kept down as far as possible. (2) The insects should be attacked early with soap and water, and the watering should be repeated.

On large areas, as in field cultivation, no treatment will avail when widespread attack has been neglected.

ROSE APHIDES.—Different species of the genus *Siphonophora* are found on roses. One of these, *S. rosæ*, migrates to teasel and returns later in the year.

Treatment.—Spraying should be done with the soft-soap and quassia spray, but only 4lb. of soap should be used. Spraying should be carried out twice in the same week.

THE PLUM APHIS (*Aphis pruni*, Reaumur).—This Aphis is a serious pest on plum, damson, and allied Rosaceous fruit trees. The loss of sap due to its feeding causes the leaves to curl and discolour, and the young fruits fall off.

The eggs found in autumn and winter are shining black. The young from the eggs are green or dark green; they develop into wingless viviparous females, which vary in colour from green to olive-brown. The pupal stage or stage preceding the winged viviparous female is characterised by rudiments of wings or wing-cases; the body is green and the wing-parts brownish. The winged viviparous female is apple-green, with the antennæ, head, upper surface of thorax, and the feet, black.

Of the sexual individuals, the males are small; they have wings and are yellow-brown or black in colour; the egg-laying females are small and wingless; they are greenish-yellow in colour, and transparent.

Life-History.—Fertilised eggs are laid in the autumn on the twigs and at the base of the buds. The winter is passed in the egg stage. Hatching takes place in spring, the young from the eggs developing into adult females, which are wingless and give rise to live young. These in turn become adult wingless viviparous females. As the season advances some of the young, instead of developing as stated, show wing-rudiments and develop into winged viviparous females. These may spread the infection. Late in the year males and wingless egg-laying females are found, and fertilised eggs are laid, which remain unhatched over the winter.

Treatment.—(1) Spraying should take place with soft-soap and quassia wash, or with paraffin emulsion, early in the year, when the young Aphides are noticed to have hatched out. The spray should always be applied before the leaves have curled. (2) Spraying should also be done in the autumn with paraffin emulsion, in order to kill the egg-laying females, e.g., late in September or during October. (3) Theobald writes favourably of a late winter wash, where the pest is abundant, the plums and damsons to be heavily sprayed with lime-wash, salt, and water-glass *just before* the bursting of the buds. This wash is said to prevent the hatching of eggs; the formula given is 1 cwt. lime, 30 lb. salt, and 5 lb. water-glass to 100 gallons of water.

Another Aphid found on plums and allied fruit plants is *Hyalopterus pruni*, Fab. As a spray against this Aphid, which is found on the under surface of the leaves, Theobald quotes a correspondent's treatment as very satisfactory, viz., paraffin emulsion, with 1 lb. of liver of sulphur added for every 100 gallons of the wash.

A third Aphid which in certain stages of its life-history is found on the genus *Prunus* is *Phorodon humuli,* described in Leaflet 88. This species is distinguished from the others by two marked projections from the forehead, between the antennæ.

THE CHERRY STEM BORER, *SEMASIA WOEBERIANA*, SCHIFF.

WALTER E. COLLINGE, M.Sc., F.L.S., F.E.S.

DURING the early part of 1908 my attention was drawn to the damage occasioned to cherry trees in various parts of Kent by the larvæ of a small moth commonly known as the Cherry Stem Borer, and later to similar damage to cherry trees in Hertfordshire. The pest increased during 1909 and 1910, and as the known remedial measures have only proved partially successful, various experiments have been made, an account of which is now given.

This insect has long been known to economic entomologists. Kollar [1] gave an account of it in 1837; it is also mentioned by Taschenberg,[2] Stainton,[3] Kaltenbach,[4] and other writers. Wilkinson [5] records it from the Edinburgh and Belfast districts, and Theobald mentioned it in 1897,[6] in his annual reports for 1906, 1907, and 1908, and again in his work on Fruit Tree Pests.[7] I have failed to find any reference to it in the writings of Westwood, Curtis, Whitehead, or Ormerod.

I am informed that it has been seen in past years in some parts of Worcestershire, but I have no personal knowledge of it beyond its occurrence in the two counties mentioned above.

Trees Attacked and Damage Done.—Whilst the cherry seems to be more prone to attack than other trees, this insect has also been recorded as attacking almond, apple, laurel, nectarine, peach, and plum trees.

The damage done consists of borings made through the bark into the sapwood. Often these are very small, but when a tree is badly attacked large cavities are formed, two to four inches in depth and about the same width, extending from about one to three feet in length. Trees so infested are frequently attacked by fungi, the lower part of the stem quickly rotting and finally dying.

Life History and Habits.—The moths of the first brood appear in May and June, and the females deposit their eggs

[1] A Treatise on Insects injurious to Gardeners, etc., Eng. Trans., 1840, p. 236. [2] Prak. Insekten-kunde, 1879, ii., p. 220. [3] Man. Brit. Butterflies and Moths, 1859, vol. ii., p. 241. [4] Pflanz. Klasse der Insekten, 1874, pp. 150, 168, and 193. [5] British Tortrices, 1859, p. 196. [6] Journ. Bd. Agric., 1897, p. 165. [7] Insect Pests of Fruits, 1909, p. 188.

in crevices or cracks in the bark, usually close to the ground. In one case where two main roots were partially exposed it was noticed that all the eggs were deposited at the junction between stem and root. I am not able definitely to state the number of eggs; they are not all deposited together, but in isolated groups. From observations made during the past three years it would seem that they are not particularly numerous. They hatch in from five to seven days.

Immediately on hatching the larvæ commence to feed upon the bark, tunnelling beneath it and forming irregular cavities by eating the inner bark and sapwood, sometimes penetrating as deep as three to four inches. Their presence can be easily detected by the holes made for extruding the frass. Exudations of gum are also noticeable on the trees, and not unfrequently fungi attack the exposed portions of the roots and stems.

The larvæ become full fed about the middle or end of August and pupate on the walls of the cavities. The full fed larvæ measure slightly more than half an inch in length, and are usually of a pinkish white or fleshy colour; occasionally they are found of a creamy white colour or even very pale brown. The moths appear in about fourteen days. About the time the moth is ready to emerge the pupa pushes its way through the bark. The pupa, which is enclosed in a cocoon, is deep brown in colour.

The eggs from this brood are laid in September, and the larvæ live beneath the bark until the following spring. They continue to feed until the end of October, and commence again at the end of March or early in April.

Preventive and Remedial Measures.—Theobald[8] mentions amongst preventive measures smearing the trunks with grease and paraffin, cow-dung or clay and lime, and thickly coating the stems with pitch. Brushing or painting with arsenate of lead and clay has not been found effective.

My own experiments were designed with a threefold object, viz., (i.) to make the surface of the stem obnoxious to the moths in order to prevent egg laying; (ii.) to prevent the newly hatched larvæ from boring into the bark; and (iii.) to destroy the larvæ in the cavities beneath the bark.

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[8] *Tom. cit.*, p. 191.

(i.) Various substances have been tried upon the surface of the bark, *e.g.*, grease and paraffin, bone oil and paraffin, etc., none of which, however, were more than partially successful.

(ii.) Two experiments were made with a view to prevent the newly hatched larvæ from entering the bark. In one case the lower part of the stem was covered with pitch and gave very fair results, whilst in a second case the pitch was mixed with slaked lime, the two well worked together, and then applied to the lower part of the stem with a stiff brush. Before drying the whole of the surface was well dusted with lime. This proved most successful, no larvæ entering the bark. Kollar (*op. cit.*, *p.* 237) mentions that egg laying may be prevented and the caterpillars prevented from entering the inner bark, if the trees are washed about the end of May, and again in September, with a solution of lime.

(iii.) Where the larvæ were known to be in the bark a mixture consisting of one part of powdered napthalene and three parts of clay were mixed together with water to the consistency of a paste and the trees were smeared over to a height of between two and three feet. This mixture was applied to the trees in June and again in November. In the latter case the larvæ were particularly numerous, but no further trouble was noticed after the mixture was applied. Any composition which will adhere to the tree and make the surface obnoxious to the moths will in all probability prevent egg laying.

In the case of the trees I saw in Kent, many had had the tunnels cut open and the larvæ destroyed by hand, but this constant cutting into the bark and sapwood undoubtedly injures the trees, apart from disfiguring them and leaving crevices for any stray moths to lay their eggs in.

The methods described above are both cheap and effective, and may prove of service to fruit growers who are troubled with this undesirable pest.

Root Tumours of Sugar-Beet.

Specimens of diseased sugar-beet have recently been submitted to Kew for investigation, from Norfolk, where this crop has been somewhat extensively grown during the past season. The roots bore large tumours or outgrowths, attaining in one instance to the size of a cricket ball. These outgrowths, which vary from one

Sugar-beet bearing tumour-like outgrowth. The specimen is somewhat shrunken owing to drying.

to three in number, originate from points near to the crown of the root, and are attached by a comparatively small neck, although during growth the tumour spreads over the surface of the root, and appears to be attached to it by a broad surface (see illustration). In some instances the tumours are quite solid, in others they are more or less cavernous or spongy.

This disease has been known since the year 1839, in countries on the Continent where beet is extensively grown, and has been investigated by several independent plant pathologists. The conclusion from their investigations is, that the disease is primarily due to the conditions under which the beet is grown, or, in other words, the disease is of a pathological nature, and that neither insect nor fungus has any share in causing the injury. From this it follows that land that has grown a diseased crop of beet, is not infected in such a way as to interfere with a future crop. At the same time, it is advisable to remember that land that has proved to be unsuitable for the cultivation of sugar-beet, and has caused the formation of tumours, would be very likely to do so on a future occasion.

On the Continent the fact is well established that tumours only develop on sugar-beet when grown on very dry, more or less sandy soil, and that no trace of the disease has been observed on roots grown in somewhat cold, wet, loamy soil. This is said to be in accordance with the experience of Norfolk sugar-beet growers.

The tumours originate from the hypertrophy, or excessive enlargement of small lateral rootlets. Roots bearing tumours contain no cane-sugar, and are therefore useless for crushing or for feeding purposes. The cane-sugar and invert-sugar present in the normal root pass into the tumour, where the former is first reduced entirely into invert-sugar. This product, due to the growth and respiration of the tumour, eventually becomes broken up into carbonic acid gas and water.

The tumours bear a superficial resemblance to outgrowths on the roots of sugar-beet, caused by a fungus called *Urophlyctis leproides,* Magnus.

The Board have received from the Cooper Laboratory for Economic Research, Watford, the following note by Mr. W. H. Barlow, F.I.C., on some analyses of seaweeds:—In view of the importance of seaweed as a manure in certain districts, as recently pointed out by Dr. Russell (Journ. Board of Agric., September, 1910) the following analyses, made by the writer in the spring of 1905, may, it is thought, prove of additional interest.

Analyses of Seaweeds.

Three varieties of Fucus were examined, viz., *F. nodosus, F. serratus*, and *F. vesiculosus*. They were collected at Padstow (N. Cornwall) in March, 1905.

In the following table the analytical results are calculated in each case on the dry material:—

	Fucus nodosus.	*Fucus serratus.*	*Fucus vesiculosus.*
Organic matter	73·99	76·97	71·35
Ash	26·01	23·03	28·65
Nitrogen	1·78	2·88	2·29
Potash	4·47	5·00	6·29
Phosphoric acid	0·29	0·55	0·45

In many respects the results are similar to those obtained by Dr. Russell and Mr. Hendrick for Thanet, Jersey and Scotch seaweeds. In the case of *F. serratus* the phosphoric acid was considerably higher than that found in the Thanet specimen referred to.

The total alkalies in the three varieties examined were found to be nearly uniform. Calculated upon the ash, they were as follows:—

	Soda. Na_2O.	Potash. K_2O.	Total Alkalies.
F. nodosus	23·19	17·19	40·38
F. serratus	17·76	21·69	39·45
F. vesiculosus...	18·72	21·94	40·66

Lime was not estimated.

Cultivation of Asparagus in Evesham.

Asparagus cultivation in Evesham is practically confined to the heaviest land. This ranges from a medium loam to a true clay, the latter often so heavy that it can only be dug in winter during a frost, as the men cannot get a foothold under other conditions. On the lighter land it does not do well, and is but little cultivated on such soils. The failure is not due to the lightness of the land so much as to its small water-holding power. The light soils are not deep like the alluvial soils found in the fen country, and

the plants suffer from drought in summer, a period when they need a large supply of water.

Preparation of the Ground.—In the autumn the soil is well dug and the subsoil is broken up. Manure is supplied in the previous autumn, generally taking the form of one ton of soot to the acre.

Seed.—The berries are gathered in autumn, when quite ripe, and carefully preserved till next spring.

Cultural Operations—first Spring.—The seed is drilled in on a dry day in March in rows 9 inches apart. This gives sufficient room for the hoe to be used subsequently. Hoeing is continued through the year whenever weeds show themselves.

Second Spring.—The roots are raised and transplanted into their permanent position. Some growers plant them in rows 1 yard apart, others 42 inches. The latter is the better distance.

Planting.—The roots are sometimes, though not always, trimmed before planting. Each root is set 9 inches to 1 foot apart from its neighbour in the row, so as to give room to hoe in between. A foot is generally considered to be better than 9 inches, but both are practised.

There are two methods of actually planting the roots:—
1. By channelling them in: In this method a channel about 3 inches deep is drawn and the roots placed on their sides "head to tail" all along the channel. Earth is then drawn over with a hoe, and then trodden down by the operator.
2. Pinning them in with setting pins: The roots are placed at the proper distance apart, and each is then fastened in by a "setting pin."

Further Cultivation during the Second Year.—Sometimes dwarf beans or parsnips are planted in between the rows. The former crop does not appear to hurt the asparagus in the first year after transplanting, but the latter is too exhausting, and should not be planted.

The subsequent cultivation varies slightly in detail. The following are two methods practised:—

A. *Second Autumn.*—A little soil is pulled up to the plants by means of the hoe. The stalks are not cut off, but left till the following spring.

Third Spring.—A light trench is dug between the rows and the soil placed on the plants, but it is important to see that the plants are not too heavily loaded.

Third Autumn.—The trench is completed, and the plants are fully earthed up.

B. *Second Autumn.*—In this method the stalks are cut off and burned when ripe, and fish guano is sown along the line of the cut off stalks. No particular quantity is used, but it is lightly sown by hand.

Third Spring.—When the new buds appear they are slightly covered with mould.

Third Autumn.—A line is drawn between the alleys, and a man digs along this line, putting alternate forkfulls on either side.

Fourth Spring.—In February–March the beds are forked with a four-pronged fork, in order to get the stones and weeds on the top of the ridge. The stones are then removed by women. After three weeks the beds are moulded up with a hoe, and this operation is continued as long as the beds require hoeing. This cleans the beds and brings the weeds to the top of the bed, where they can be picked off separately.

The first cutting takes place this year, and is continued, as a rule, till June 26th. Beds which are properly treated, and from which cutting is not continued too late in the year, should certainly last 20 years, and cases are known where they have lasted very much longer than this.

The further cultivation is fairly simple. The beds are hoed in the summer whenever necessary, and in the late autumn they are dug over, so as to bring them up to the original height which they had lost owing to the washing action of rain.

Every alternate year soot is given to the amount of about 1 ton to the acre. Sometimes fish guano is given in the years when no soot is applied. An alternative to this treatment is to apply soot and lime every autumn. This mixture is probably more useful by reason of its physical properties than its chemical. The lime improves the tilth of the heavy clay land on which the asparagus is grown, and the soot no doubt increases the absorptive power of the soil for heat.

DISEASES OF ASPARAGUS.—The two chief pests are :—1. The asparagus rust (*Puccinia asparagi*); and 2. The asparagus beetle (*Crioceris asparagi*).

The Rust.—This fungus disease is apparently usually present in a mild form, but occasionally it has developed into an epidemic. The following account is based on facts supplied by a grower who was cultivating asparagus at the time :—

The epidemic started in 1896 and lasted until 1900. These years were characterised not only by dry summers, but also by dry winters.

The influence of drought appears to be two-fold. According to Duggar the two factors that favour the fungus are :—1. Presence of heavy dew. 2. Absence of sufficient moisture to keep the host plant actively growing. Both these conditions are fulfilled in an ordinary dry, hot summer, while a dry winter would still further lower the total water content of the soil, and stop the proper summer growth of the plant.

The disease was found on all the kinds of soils on which asparagus is grown, *i.e.*, from medium loams to heavy clays. The disease appeared some time during the early summer, and the "bower," or stems which are allowed to grow, ripened off in August instead of October. The disease appeared first of all in brown patches, which must have been the uredospore stage, and subsequently in black patches, which is the teleutospore stage. This latter stage seems to be present every year, and causes the bower to ripen off a dull brown colour instead of a golden yellow. The aecidial stage was apparently not seen. The result of this premature ripening in August was that the roots were considerably weakened; in fact, a slow starvation took place.

The crop the next year was a poor one, and very soon the beds ceased to pay. Many were grubbed up in consequence, but some which were allowed to remain paid again a year or two after the disease had ceased to be epidemic. After 1900 many new beds were laid down, and now there is certainly a far larger acreage under asparagus than ever before.

The disease, however, is still present, and under suitable conditions might again become an epidemic. Some spraying

with Bordeaux mixture was tried, but it appeared to have no effect, and no other remedies were tried.

The Asparagus Beetle.—This occurs locally, but does not appear to do much damage, at any rate, not much damage is complained of. The beetles themselves cause a certain number of malformed stalks, and the larvæ feed on the "bower," but do not seem to do much harm. A full account of this beetle is given in Leaflet 47.

Tomato Cultivation for Allotment Holders.

An example of the suitability of tomato cultivation for allotment holders is afforded by some results obtained during the past season, which have been communicated to the Board by a correspondent.

The holding in question was a small allotment garden on the outskirts of a large town in Yorkshire, and was owned by a working man. The plants to the number of 300 were grown in two greenhouses, each 80 feet by 9 feet. The tomatoes sold amounted to over 950 lb., and a ready market was found for all that could be produced at 4*d*. per lb. wholesale. A proportion was also sold retail on the holding at 6*d*. per lb.

The holding was not occupied until June, 1910, otherwise a much larger crop would have been obtained.

County Staffs of Instructors in Agricultural Subjects.

The Rural Education Conference, which was constituted by Minutes of the Presidents of the Board of Agriculture and Fisheries and of the Board of Education dated 4th February and 20th June, 1910, has presented a Report, in response to a reference by the Boards, on the County Staffs of Instructors in Agricultural Subjects. Though the Boards have not yet considered the Report, it has been thought desirable to publish it for general information.

The reference, which was submitted for the opinion of the Conference, was as follows:—

"As to whether it is desirable that each county should have its own staff of instructors in Agriculture, Horticulture, and other allied subjects, or whether it is possible that the

services of a single staff should be made available for groups of contiguous counties; as to the training and qualifications which such instructors should possess in order to enable them to secure the confidence of agriculturists; and as to the manner in which the staff should be composed for each county or group of counties in England and Wales in view of the different branches of rural industry followed in each locality."

The Report in the first place reviews the position of the different counties in this respect, and points out that the great majority of counties have some separate staff of their own, and that the only grouping of counties is for the purpose of establishing or assisting to maintain a joint college or institute or (more often) arises out of association with such a centre for agricultural education and research. In the case of certain counties (*e.g.*, Devon and Cornwall), no centre at present exists with which they could conveniently be associated. The independent staff of the county is often supplemented, and their work often supervised, by the staff of the centre with which the county is in association. It must be remembered, however, that hitherto there has been no adequate inducement to counties to combine for the purpose of maintaining an efficient staff, and that if a sufficient grant were given by the Government for this purpose considerable changes might be made in smaller counties where the salaries at present offered are insufficient to secure first-rate men. In all the larger counties not already in combination it would probably still be found desirable for each county to have an efficient staff of its own for the organisation of agricultural work not carried on at or in connection with the centre.

The Conference considers that it may be laid down as a general principle that every county either should be associated, in combination with other counties, with an efficient centre, or, if not in combination, should have a *minimum* efficient staff of its own. It is thought desirable, especially in view of the difficulty of obtaining qualified teachers and organisers, to concentrate higher agricultural education, as far as possible, in a few really efficient centres. Any County Council not associated with an efficient centre which finds itself unable or unwilling to establish a minimum staff of its own should associate itself with the Council of an adjoining county.

The minimum staff, which should consist of an agricultural organiser or adviser, an horticultural instructor, and, in most counties, a dairying instructor, would require to be supplemented by competent scientific investigators from a University or Agricultural College, and instructors in special branches of agriculture.

The Report then proceeds to define the duties and qualifications of the above-mentioned staff, and gives some specimens of the existing staffs of typical counties.

Earnings of Agricultural Labourers.

The Board of Trade have published a Report relating to the earnings of agricultural labourers in 1907 (Cd. 5460, price 8½d.). This Report is the third which has been published by the Board of Trade on the wages, earnings and conditions of employment of agricultural labourers in the United Kingdom; the first having related to the year 1898 and the second to 1902. The latter Report gave a considerable amount of detail in regard to the conditions of employment on individual farms, but in view of the very slight changes which have since taken place it has not been thought necessary to repeat this information.

The number of farmers who have rendered returns for the present Report is nearly 15,800, and the number of labourers whose earnings have been stated is over 78,000. These figures are more than twice as great as those of the preceding Enquiries, and represent all districts of the United Kingdom. As in the two previous Reports, the average earnings stated are those of adult male farm servants regularly employed, the earnings of lads, women and girls having been excluded, and also those of men temporarily engaged at the busy seasons of the year.

The returns received from the farmers gave the weekly, half-yearly, or yearly rates of cash wages in 1907 at which the men were engaged and the total amount of cash actually paid to them in the year, the latter amount including all extra payments at hay and corn harvests, piece-work earnings, overtime money, journey money, lamb money, &c. The rates of pay of men provided with board and lodging by their employers were distinguished from those of the men not so provided, and in computing the average earnings the

estimated value of the board and lodging has been taken into consideration. Other men frequently received allowances in kind, *e.g.*, free houses, allotments, potatoes or potato ground, meal, milk, beer, fuel, &c., in addition to cash wages, and the value of these has also been included in the average earnings. Speaking generally, the labourers boarded and lodged are unmarried, and those to whom other allowances in kind are granted are married men.

From the particulars of total annual earnings the average weekly earnings, for the year 1907, of the various classes of agricultural labourers in each county of the United Kingdom have been obtained by dividing the annual amounts by 52. For all classes of labourers combined the average annual earnings and the corresponding weekly amounts, in the four countries, were as follows:—

	Total Earnings in the Year.		Average Weekly Earnings.	
	£	*s.*	*s.*	*d.*
England	47	15	18	4
Wales and Monmouthshire ...	46	16	18	0
Scotland	50	19	19	7
Ireland	29	4	11	3

In ten counties in the United Kingdom the average weekly earnings were 21*s.* or above, and of these counties three, Durham, Northumberland and Lancashire, were in England, and seven, Dumbarton, Stirling, Lanark, Clackmannan, Fife, Linlithgow and Renfrew, were in Scotland. The five counties in which average earnings were lowest were all in Ireland.

The county in England with the highest average earnings was Durham, with 22*s.* a week, and the lowest Oxfordshire, with 16*s.* 4*d.* The county in Wales with the highest average earnings was Glamorganshire, with 19*s.* 3*d.*, and the lowest Cardiganshire, with 16*s.* 6*d.* In Scotland, Dumbarton had the highest average (21*s.* 7*d.*) and Caithness the lowest (14*s.* 6*d.*). In comparing these earnings with those of labourers in industrial towns it should not be forgotten that the rent of cottages is much lower in country villages than in towns. Moreover, the village labourer has opportunities for growing vegetables or of obtaining them at lower prices than the urban workman.

In England and Scotland agricultural labourers are usually

classified, according to the nature of their duties, as horsemen, cattlemen, shepherds and ordinary labourers, but in Wales and Ireland, owing to the large number of comparatively small farms on which the few labourers employed are required to perform indiscriminately any necessary duties, such distinctions are not generally made. The average weekly earnings in 1907 of horsemen, cattlemen, shepherds and ordinary labourers in England and Scotland were ascertained to be:—

	England.		Scotland.	
	s.	*d.*	*s.*	*d.*
Horsemen	18	9	19	8
Cattlemen	19	1	19	4
Shepherds	19	7	20	5
Ordinary Labourers	17	6	18	11

In explanation of the somewhat higher earnings of horsemen, cattlemen and shepherds, it may be stated that they have greater responsibilities and longer working hours than the ordinary labourers. On week-days their working time is frequently longer than that of an ordinary labourer, and the animals in their charge also require attention on Sundays. The hours of labour of ordinary labourers in the summer months are usually 11 or 12 per day, with intervals of $1\frac{1}{2}$ to 2 hours for meals; in a few cases the working time on Saturdays is slightly reduced, but this is not general. In winter the working time is generally limited by the hours of daylight.

The average earnings in 1907 of the predominant class of agricultural labourers, when compared with the average earnings in 1898, the date of the first Enquiry, show a rise of 5 per cent. in England and of 8 per cent. in Scotland. As compared with the earnings prevailing at the date of the second Enquiry (1902), the averages show little change.

For a certain number of farms information has been furnished as to the course of wages of ordinary agricultural labourers in England, Wales and Ireland, and married horsemen in Scotland over a much longer period and in all four countries the figures indicate a material rise. The average wages at these farms in 1907 were higher than the average wages in 1880 by 10 per cent. at the 156 farms in England and Wales, 17 per cent. at the 98 farms in Scotland, and 24 per cent. at the 27 farms in Ireland.

The Lords Commissioners of the Treasury have, on the recommendation of the Development Commissioners, made a Grant to the Board of Agriculture and Fisheries from the Development Fund of £40,000 for the ensuing year for the encouragement of light horse breeding in Great Britain by means of

Grant for the Encouragement of Light Horse Breeding.

(1) The award of premiums to stallions.

(2) Grants for the purchase of half-bred working brood mares for location in selected districts.

(3) Free nominations for suitable mares for service by premium or approved stallions.

(4) The purchase (for re-sale) of stallions.

(5) The voluntary registration of stallions.

The President of the Board proposes at once to appoint an Advisory Council composed of persons intimately acquainted with the industry in various parts of the country to advise and assist the Board generally with respect to all matters connected with the industry of horse breeding.

Until this Council has been constituted it is not possible for the Board to make public the details of the manner in which they propose that their scheme will be carried out, but in view of the necessity for making preparations for the breeding season of 1911 without delay, the Board think it desirable to give the following information on the subject.

Premiums to Stallions.—The premiums to be awarded will be of two classes, viz.:—

(1) *King's Premiums.*—King's Premiums will be awarded at the Spring Show to be held in London on the 7th, 8th, and 9th March next in connection with the Hunters' Improvement Society's Show, and will be made up of (*a*) a fixed amount to be paid on the award being made, (*b*) of a service fee for each mare covered during the season, and (*c*) of a further fee for each foal produced. The owner of a King's Premium stallion will be required in each case to enter into an agreement to allow the stallion to serve, if required, not fewer than 50 mares, exclusive of mares for the service of which a free nomination has been given by the Board to the owner of the mare, and any mare which has been purchased or leased to a farmer or other person in connection with the

scheme. Service fees will not be paid for more than 90 mares in any one year. The fee to be charged to the owner of a mare by the owner of the stallion is to be limited to £2, exclusive of the groom's fee (2*s*. 6*d*.). The amounts of the various payments have been so arranged as to secure that the owner of a King's Premium stallion which travels a district and serves 50 mares will, on an average, receive approximately £150 in the season, in addition to the fees payable by the owner of the mare.

(2) *Board's Premiums.*—The stallions for whom these premiums are paid will be selected either at a local spring exhibition or by the Board themselves on the application of the owner, and will in all cases be subject to approval as to soundness and suitability by a veterinary surgeon nominated by the Board. The Board's Premium will be made up of service and foal fees, and, as in the case of a King's Premium stallion, the owner of the stallion will be required to enter into an agreement to allow his stallion to serve, if required, not fewer than 50 mares, exclusive of mares for the service of which a free nomination has been given by the Board to the owner of the mare and of any mare which has been purchased or leased to a farmer or other person in connection with the scheme. Service fees will not be paid for more than 90 mares in any one year. The fee to be charged to the owner of a mare by the owner of the stallion is to be limited to £1, exclusive of the groom's fee (2*s*. 6*d*.). The amounts of the various payments have been so arranged as to secure that the owner of a Board's Premium stallion which travels a district and serves 50 mares will, on an average, receive approximately £75 in the season, in addition to the fees payable by the owner of the mare.

Both in the case of a King's Premium stallion and a Board's Premium stallion the covering fee will be larger in amount where the stallion does not merely stand for service, but travels in the district.

The Board also propose to award a limited number of premiums of smaller amounts for pony stallions.

Purchase of Brood Mares.

It is proposed that the moneys available for this purpose shall be expended locally through the agency of County Com-

mittees and Sub-Committees. The Board hope to be in a position to provide for the purchase of young half-bred working mares of good quality and of suitable conformation with a view to re-sell or lease them on certain conditions to the holders of suitable farms for the purpose of mating them with premium or other approved stallions. The sum available for this purpose should suffice for the purchase of upwards of 200 mares during each year.

Free Nominations for Mares.

The Board also hope to secure the distribution of a number of free nominations for service by King's Premium or Board's Premium stallions, through the agency of the County Committees. A nomination, whether to a King's or to a Board's Premium stallion, will represent the fee which the owner of the mare would otherwise himself have to pay for the services of the stallion. The intention is that these free nominations, about 1,400 in number, shall be allocated by preference to the smaller tenant farmers and others in respect of the best of the young mares in their possession.

Purchase of Stallions.

The Board propose to expend a considerable sum on the purchase of thoroughbred stallions for re-sale on special conditions, with a view to securing the use in the district of a stallion of somewhat higher class than could otherwise be obtained, and of providing suitable stallions in districts where at present their services are not readily available. It is hoped by this means to secure the retention in this country of a certain number of stallions which would otherwise go abroad. The number thus purchased in any one year cannot be large, but it is believed that in the course of time a substantial benefit to the industry will accrue.

Registration of Stallions.

The voluntary registration of stallions by the Board is not to be confined to light horses only, but will be extended to stallions of all breeds entered in the recognised Stud Books. It is intended that registration shall be carried out free of cost to the owner, except in the case of a stallion serving at a fee exceeding £10, exclusive of the groom's fee, in which case the expense of veterinary inspection will be borne by the

owner. The main object of the proposal is to establish a recognised standard of soundness for breeding purposes. The owner of a mare will know that any registered stallion has been examined by a competent authority and passed sound for service. As regards the suitability of the horse from other points of view he will still have to rely upon his own judgment, but in one important respect, at any rate, his choice will be made more easy.

The responsibility for the administration of the Grant as a whole will rest with the Board, who will have at their disposal the assistance of the proposed Advisory Council representing all branches of the industry. In many important respects the detailed administration of the scheme will be left in the hands of the County Committees, without whose co-operation proposals of this magnitude could not successfully be undertaken. The Secretary of State for War has stated that the War Office will be prepared to purchase annually a certain number of the remount horses at 3 years off, and he has promised the co-operation and assistance of the Army Council, who will be represented at the meetings of the Advisory Council. If, as it is confidently believed, the willing assistance of all concerned in the industry can be secured for the carrying out of these proposals, there is good hope that the value of the industry can be materially increased and an important benefit to agriculture secured.

Credit Banks in France.

During recent years the French Ministry of Agriculture may be said to have made a determined effort to introduce the system of credit banks into France. Prior to 1899, though the formation of such banks was recognised and regulated by law, the State took no direct steps to provide them with funds.*

In March, 1899, a law was passed authorising the Government to apply a certain fund to the purpose of making advances, free of interest, to district or regional banks. This fund was made up of a lump sum of £1,600,000 paid in 1897

* A law of 20 July, 1895, authorised Savings Banks to apply one-fifth of their capital and the whole of the revenue to loans to co-operative credit banks. The capital sum available in this way is about £800,000, but owing possibly to the provisions of the law of 1899, the credit banks have not taken advantage of this earlier law.

by the Bank of France for the renewal of its privileges, together with an annual payment or rent of not less than £80,000, up to the year 1920. The latter amount, however, has been considerably exceeded, with the result that the fund available for loan to credit banks was over £4,000,000 in the early part of 1910. The amount to be lent to any district bank was, however, limited to four times its paid-up capital, with the result that the actual sum advanced by the State to the middle of 1910 was only about £2,200,000.

The progress that has been made is regarded by the French Ministry of Agriculture as encouraging, and it is anticipated that in time credit banks will be established in all districts of any importance. The following figures show the progress during the past nine years:—

	1900.	1909.
State loans	£24,500	£1,850,000
Number of district banks	9	95
Number of affiliated local banks ...	87	2,983
Number of members	2,175	133,382
Total amount of loans granted... ...	£76,000	£4,201,000

It will be seen from the above figures that the number of members in each society was in 1909 about 45. The total amount of money lent on loan in each of these local societies was relatively substantial, being on the average about £1,400 in the course of the year, though the whole of this sum would not necessarily be out on loan at the same time. As an example of the extent to which these banks are used, it may be mentioned that the aggregate amount of the loans granted since 1899 has been not less than £20,700,000.

In order to encourage the creation of these banks, the French Ministry of Agriculture has established a Bureau for the special purpose of assisting them by the distribution of information. This Bureau issues model rules, handbooks, etc., and acts generally in an advisory and administrative capacity. In addition, the powers and duties of the district banks, through whom the State funds are lent, are very strictly defined by laws and decrees, which, among other matters, require inspectors attached to the Bureau to examine the accounts of the banks, and to satisfy themselves that the legal requirements have been fulfilled.

Local Banks.—In the case of the local bank a very considerable amount of liberty is given as regards its formation and

management, but in practice this liberty is much restricted by the fact that in order to benefit in any way from the State funds it must be affiliated to a district bank. This means that its rules must be submitted to and approved by the district bank, which, after affiliation, has very distinct powers of control and supervision over its operations. Subject to this, however, a local bank can be founded on the principle of the unlimited liability of the members (with a paid-up capital), or on the liability of the members to the extent of two, three, or four times the shares they have taken up, or on a liability limited simply to the shares taken by each member. Legally, a bank can also be based on the unlimited liability of the members, but without a paid-up capital, in the same way as the Raffeisen Banks of Germany; such banks, however, not being in a position to contribute to the resources of the district bank (owing to the absence of capital) do not, generally speaking, participate in the benefits afforded by the State loan. A considerable number of them were formed prior to 1899, and continue to exist as organisations independent of the State with their own federations. The model rules prepared by the Ministry of Agriculture provide as a matter of preference for the liability of the members being limited solely to the amount of the shares subscribed, and the Ministry regards this system as best suited for countries or regions where the co-operative spirit is not much developed.

The members of a local bank must also be members of an agricultural association, but the number required for its foundation need not exceed seven. Each of the members must subscribe for not less than one share, varying from 16*s*. to 32*s*., of which only one-fourth need be paid up. The affairs of the bank are administered by a committee, and on its formation the committee applies for affiliation to the district bank, and then obtains from that institution full instructions and advice as to the management of the business. Briefly, the system is as follows:—

The Bank is usually open once a week. The rate of interest charged is about 4 per cent., or 1 per cent. above that charged by the district bank, which in its turn is dependent on the discount rate of the Bank of France; this difference is intended

to cover the expenses of the local bank, and to enable it, if possible, to accumulate a reserve.

On granting a loan, the borrower is required to sign a bill in a negotiable form for the sum lent, and the bank generally requires in addition either the guarantee of a second person, who also signs the bill and makes himself responsible for the payment, or, alternatively, the deposit of some definite security. The duration of the loan varies according to the nature of the object to which the money is to be applied. Thus loans for the purchase of manures to be applied in the autumn would be for one year, in order to allow the crop to be gathered, while for manures applied in the spring as top-dressings they would only be for six months; loans to enable crops to be held over, instead of being sold at once, would be granted for three months. The principle which is recommended for adoption is that the loan should always be for a specific purpose, and that payment should be made as soon as the purpose is fulfilled. Loans should not be renewed or extended beyond the time fixed, but this in no way excludes a subsequent application for a fresh loan for some other purpose.

Regional or District Banks.—The district bank, of which there is usually one to each Department, acts as banker to the local banks within its area, discounts their bills, and advances them money. The local banks are usually the principal share-holders, and a substantial portion of their capital is applied to this purpose. When the district bank has been formed, it applies to the State for an advance, the amount of which is limited to four times the amount of the paid-up capital, but which may be any less sum. The district bank would then be required to deposit a portion of this sum in the form of Government securities, etc., with the Bank of France to serve as a guarantee. The balance would be placed in a current account. The regional bank would then be in a position to commence operations by discounting the bills of the local banks, and supplying them in this way with the funds to advance to their borrowers. As far as possible, this would be done from its own funds, but when these were exhausted, the bills received would be discounted at the Bank of France. The district bank naturally takes

great precautions to see that the bills presented by the local bank are satisfactory, it makes itself acquainted with all the circumstances of the bank and of the district, and controls the total sum lent to a local bank, so that this sum bears a relationship to the paid-up capital, and to the contributions to the capital of he disrict bank. Additional security, such as the personal guarantee of the committee, is often required.

By a law dated 11th April, 1905, the district banks are required to make various returns to the Ministry of Agriculture, and, as stated above, their accounts are to be examined by Inspectors appointed for this purpose. All applications for advances from State funds are to be submitted to a committee of the Ministry, which is also to have before it in the case of banks in operation, the last report of the inspector. Any advance so made may be recalled in the event of the regulations not being complied with. The district banks in their turn are required to exercise a regular and effective control of the local banks.

It will be seen that the system represents broadly the stimulation of local effort by public loans. A proportion of the capital of these banks is subscribed by the persons interested, and forms to some extent a guarantee that the remainder of the capital furnished from State funds will be properly used. The risk of loss arising is further diminished by the deposit of a proportion of the loan as security with the Bank of France, by the guarantees required with every loan, by the supervision of the various bodies concerned over one another, and by the fact that the loans are only intended to be granted for well-defined objects, about which the committee of the local bank can obtain information.

Long Loans to Small Holders.—The scheme described above for the provision of loans for short periods has been extended or completed by a law dated 19th March, 1910, so as to enable loans to be made, by means of the same machinery, to small holders to enable them to carry out permanent improvements, and to make changes in cultivation. It also provides for the acquisition of land for holdings and the redemption of mortgages. The law is only applicable to "small holdings" (*petites exploitations*), and no single loan is to exceed £320. The duration of the loan is limited to 15 years,

to be paid off by annual or occasional instalments or otherwise, with interest usually at two per cent. per annum. The loan is to be secured by mortgage on the land, supplemented, if necessary, by personal sureties; exceptionally, the mortgage may be dispensed with, and personal sureties or security such as a life insurance policy may be accepted. The loans are made through the local and district banks, the money being furnished by the State free of interest.

Changes in Farming Methods in the United States.

A question which is attracting a good deal of attention in the United States at the present time is the need for a change in some of the prevalent systems of farming. It is recognised that the at one time virgin soil is beginning to show signs of exhaustion, and that it is becoming increasingly necessary to adopt the rotation system which prevails in the older countries of the world.

During the last sixty years an enormous area of land has been brought into cultivation, and while this land was new and fertile the production of crops was accomplished at little expense, and without any attempt to maintain the fertility by manuring or by a change of crops. When land in the older States became less productive there was a tendency to move out to newer regions where virgin soils could still be obtained. The area of undeveloped land is now, however, relatively limited, and it is much less easy than was formerly the case to find new land that can profitably be cultivated on the single crop system. This has led to an increase in the price of land, and with it to an increase in tenant farming. The exhaustive system of farming by the continual growth of crops without return, which was perhaps natural in the case of virgin soil, seems to have been continued on these tenant farms without any of those safeguards against exhaustion which have been found necessary elsewhere. It is stated * that "leases are usually made for short terms. The renter has no interest in maintaining the fertility, for he has no assurance that he will receive the benefit of it. He is interested only in immediate results. He therefore proceeds to rob the

* "Soil Conservation," Farmers' Bulletin, No. 406, U.S. Dept. of Agric.

soil by exploitive methods of farming similar to those which prevailed when the land was first put into cultivation."

It is recognised that this extravagant system of farming cannot be continued indefinitely, and the United States Department of Agriculture is now endeavouring to spread a knowledge of the principles of soil fertility among farmers in order to enable them to utilise the resources at their command. In the first place, it is considered that there must be an increase in the number of live stock kept on farms, and where land is let, the leases must be made for longer terms. Where the tenant cannot provide a sufficient head of live stock it is suggested that they should be supplied by the landlord. The use of leguminous crops, such as clover, lucerne, peas, &c., a systematic rotation of crops, the increased use of artificial fertilisers, the improvement of seed, the utilisation of home-grown feeding stuffs for live stock, and, in short, all the principles involved in a sound system of agriculture as understood in this country and in Europe are now being advocated as essential to successful farming in the United States.

Changes such as these are likely to be slow; they require both more capital and more labour than have hitherto been available, but with their gradual introduction they are likely to influence the position of the United States as an exporter of agricultural produce.

SUMMARY OF AGRICULTURAL EXPERIMENTS.

Experiments on Cattle Feeding (*Cornwall C.C., Rept. on Cattle Feeding,* 1907 *and* 1908).—Fattening Bullocks on Pastures.—In 1905 and 1906 it was found that at current prices maize was a more economical feeding stuff for fattening bullocks on pastures than linseed cake. In 1908 the question whether cooking and drying the maize was profitable was examined. One lot of nine steers were given 7 lb. of maize meal per head daily, while another lot of nine received the same weight of cooked maize. Equal results were given by each method of feeding during a trial of three months, and consequently the cost, about £2 per ton, of cooking and drying, did not appear to be justified.

Another trial dealt with the profitableness of giving purchased feeding stuffs to bullocks on rich pastures. The experiment, which lasted from July 22nd to October 24th, was conducted with twelve South Devon steers, of an average weight of 9 cwt. 3 qr. The pastures were in good condition, with an abundance of luxuriant grass. Six of the bullocks, which were fed on grass only, increased by 12 cwt. 2 qr. 8 lb. in live weight in the three months, while six which were

given 6 lb. of maize meal daily increased by 13 cwt. 2 qr, 17 lb., a return of only 20 lb. in live weight for maize meal, which cost £1 10s. Another experiment shows that when purchased feeding stuffs are given, less other food is eaten, and the report states that this experiment demonstrates that farmers should exercise judgment in this matter, seeing that other things being equal, it will not pay to give feeding stuffs on luxuriant pastures when beef and purchased feeding stuffs are at the average prices of the last seven years.

It is a common practice among farmers to put store bullocks on their best grazing land early in the summer, and to begin at once to feed them with purchased feeding stuffs. On very inferior pastures this may be necessary if the object is to fatten the animal during the summer, though it is extremely doubtful whether fattening should be attempted on such land. But the same is often done on strong grazing land, and this appears to be quite unnecessary. With a scarcity of grass, or other special circumstances, purchased feeding stuffs may always be resorted to with advantage, but the maximum of profit is never obtained by their use unless the farmer takes fully into consideration not only the quality of the other foods that are to make up the ration of the animal, but the temperature and season of the year during which the feeding is carried on.

Another experiment brought out a similar point. The object was to see whether it is desirable to feed store bullocks more liberally in winter, and with more economy during the summer than is usually done. Eight steers were fed; all received second-rate hay and grass, the only difference in the feeding being that four received 6 lb. maize meal daily from January 1st to May 1st, while the other four received an equal weight daily between March 1st and July 1st. The following are the weights of each lot of four at intervals of two months during the experiment :—

	January.		March.		May.		July.		Increase.	
	cwt.	qr.	cwt.	qr.	cwt.	qr.	cwt.	qr.	cwt.	qr.
Lot I.—(Maize from Jan. to May) ...	39	0	42	1	45	3	50	3	11	3
,, II.—(,, ,, March to July)	39	2	40	0	43	0	48	2	9	0

It will be seen that the animals receiving maize during the summer months made no greater gain than those without it, and consequently never made up the weight that the others put on through being given maize in the winter months.

House Feeding of Sheep (*Trans., Highland and Agric. Soc. Fifth Series, Vol.* 22, 1910).—Mr. Ross, of Millcraig, Ross-shire, has for many years practised a system of feeding sheep in sheds, which has been found to have considerable advantages in the trying climate of Scotland, both on account of the quicker fattening of the sheep and reduction of the usual mortality through stress of weather. A description of the sheds and the manner in which they are used is given in this article, and an account of an experiment with the system conducted by Mr. T. A. Anderson, Nanekiln.

The sheds used at Millcraig take 100 sheep each, and a set of four under one roof, with litter and food sheds attached, cost about £160. In Mr. Anderson's experiment two lots of twenty sheep each were taken, each lot being the same total weight. One lot were put into the feeding shed on January 14th, while the other lot were finished

outside under the ordinary conditions of the district, the same food being given to both lots. At the start both lots weighed 1,782 lb.; at the end of two months—a period regarded as quite long enough for shed feeding—the outside-fed lot had gained 186 lb., while the shed-fed lot had gained 284 lb., or 98 lb. more. It is stated that the weather was exceptionally stormy during the feeding, but that this only emphasizes the advantage of having the means of carrying on sheep-feeding under equable conditions at all seasons.

Manuring for Milk (*Midland Agric. and Dairy Coll., Repts. on Expts. with Crops and Stock*, 1909-10).—Mr. Blackshaw points out in this report that in the Midlands and other dairying districts there are many pastures that are not yielding to their full capacity. Milk is sold continuously, and the farmyard manure returned to the land, even when increased in value by purchased feeding stuffs, is not sufficient to keep up fertility. The only special manures used to any extent are basic slag and bone manures, and this experiment was designed to see whether superphosphate and sulphate of potash would give profitable returns.

A field in poor condition adjoining the college farm was taken, and two plots of four acres each fenced in. The soil was of a strong, clayey nature, typical of most soils on the Keuper Marl formation. On account of indications of lack of lime, 10 cwt. of ground lime per acre were applied over both plots. On one plot 4 cwt. of superphosphate and 1½ cwt. of sulphate of potash per acre were broadcasted on April 12th, while to the other plot no manure other than the lime was given. The effect of the manures was tested by the milk yield of cows. Two cows were grazed on each plot for a fortnight; they were then changed over, the two that had been on the no-manure plot going to the manured plot, and *vice versa*. This continued for five months, so that each lot of cows visited each plot five times. In order to allow the cows time to get accustomed to the different pasture, the milk of the second week of each fortnight only was taken into account, and the amount doubled to represent the fortnight's milk. By thus changing the cows from one plot to the other the effect of differences between the cows was minimised, and the only factor that would influence the result would be the manures applied. By the middle of July the condition of the manured plot was so much better than that of the other and so much ahead of the cows, that a third cow was put on it and kept there till the end of the experiment. During the five months the yield of the two cows while on the unmanured plot was 5,531 lb., and while on the manured plot 6,753 lb. The yield of the third cow on the latter plot was 2,267 lb., so that the total excess on the manured plot was 3,489 lb., or 84 gallons per acre. At 6*d*. per gallon this would be worth £2 2*s*., and deducting the cost of the manures, £1 9*s*., the gain due to their use would be 13*s*. per acre. Mr. Blackshaw considers that the results would be even more in favour of the manuring but for the well-known fact that a cow may be made to lose in yield much more readily than she can be made to recover. Thus the big drop that always took place when the cows were moved to the poorer plot was never completely made up afterwards on the richer pasture, even when the natural drop due to advance in the period of lactation is allowed for. The advantage from keeping cows always on manured

pasture over keeping them on the unmanured, would probably be greater than was found in this experiment.

Composition of Milk.—Some investigations on this subject were carried out by the Somerset C.C. in 1908, and were noticed in the *Journal*, December, 1909, p. 756. They were continued in 1909, and an account of them has been furnished to the Board by Mr. Lawrence Abram, B.Sc., who conducted the investigations for the County Council.

The tests were made with the milk of four herds consisting of Shorthorns and Shorthorn crosses, the ordinary type of cows in the dairying districts of Somerset. The following are particulars of these herds :—

	Number of Cows at beginning of experiment (April 8th).	Number at the end.	Food.
Herd A.	16 ; 14 of these calved since Feb. 1st	22	About 4 lb. hay per head daily for six weeks, after this grass only
Herd B.	11 ; all calved since Jan. 14	25	Same as Herd A
Herd C.	7 ; all calved since Jan. 1st	8	About 4 lb. cotton cake and 4 lb. hay per head daily for five weeks, 4 lb. hay for three weeks, after which grass only
Herd D.	3 ; all calved since Jan. 1st	2	Grass only

Herd A is the herd with which the investigations of 1908 were conducted; Herd D was included in the experiment in order to observe how the small number of cows affected the variations in the composition of the milk.

All the cows were out in the fields during the whole time, and were milked out of doors; as is the custom of the district, the winter feeding was gradually changed on turning the cows out to grass, so that some cows received a small quantity of hay for a time, others a small quantity of cotton cake in addition to hay, while others received grass only. The cows were milked twice daily, and the milking times were gradually changed, according to the usual practice, as the Spring advanced.

The cows were allowed to suckle their calves at first, and were brought into the experiment when the calves were sold or weaned, so that the number of cows increased as time went on. No cows were stale in milk except one in Herd D; it was decided to fatten this cow, so that her milk was not included in the sample after June 3rd.

Samples of the mixed milk of each herd were taken once a week at both the morning and evening milkings. The samples were tested for fat by the Gerber process, and for "total solids" by direct evaporation on the water bath. During the tests made in 1908 and 1909 over

1,950 samples of milk were tested for fat, and of these 723 samples were tested in duplicate, these including all samples containing less than 3 per cent. fat, and all samples giving very high or very low results.

The results of the investigation are similar to those of last year. The composition of the milk varied considerably from week to week; and although no tests were made with the milk of individual cows this shows that their milk must have varied considerably also. The limits of variation are not so wide for the mixed milk of a number of cows as for individual cows, the variations between the latter tending to equalise the composition of the mixed milk, and in this connection the effect of the size of the herd is of interest. Great similarity is exhibited between Herds A and B, while Herds C and D, which are considerably smaller than the other two, give much wider ranges of variation.

No reason for the variations in fat content could be seen, beyond the individuality of the cow. Last year's results showed that the variations could be observed when there were no disturbing influences at work, such as changes of food, changes of weather, or other known causes. There appears to be no relation between the weather conditions and the variations. Last year cold weather appeared to have a tendency to decrease slightly the quality and quantity of the milk, and warm weather to increase both slightly; much greater variations, however, were found in the course of the experiment, for which no such explanation could be given. In the present experiments the changes in the food were extremely small, and during the greater portion of the time no change at all was made.

TABLE I.,

Showing variations of the fat-content.

Herd.	Samples.	Highest Per Cent.	Lowest Per Cent.	Range of Variation.
A.	Morning	3·5	2·9	0·6 per cent.
	Evening	3·8	3·2	0·6 ,,
	All samples	3·8	2·9	0·9 ,,
B.	Morning	3·6	2·8	0·8 per cent.
	Evening	3·8	3·2	0·6 ,,
	All samples	3·8	2·8	1·0 ,,
C.	Morning	3·6	2·7	0·9 per cent.
	Evening	4·4	3·0	1·4 ,,
	All samples	4·4	2·7	1·7 ,,
D.	Morning	4·5	3·3	1·2 per cent.
	Evening	4·7	3·5	1·2 ,,
	All samples	4·7	3·3	1·4 ,,

In the case of three of the herds samples of the mixed milk sometimes contained less than 3 per cent. of fat; out of the seventeen weekly tests made in 1909 the number of times on which this occurred was as

follows:—Herd A, 1; Herd B, 3; Herd C, 9; Herd D, 0. All these were samples of the morning's milk.

It was concluded previously that the greater poverty of fat in the morning's milk tends to disappear as the intervals in the milkings are equalised, while in very hot weather where the intervals between milking are fairly equal, cows may give richer milk in the morning than in the evening, owing apparently to the greater comfort they enjoy in the coolness of the night.

It will be seen from Table II. that the average difference between the morning and evening fat-content was the greatest in the case of Herd C for each month, and also that this herd showed the greatest difference in the intervals between the milkings each month, except for July; this, together with the fact that this herd gave the largest number of samples containing less than 3 per cent. of fat, indicates that one of the most important factors in preventing the morning milk from falling below standard is the keeping of the milking intervals as nearly equal as possible. It is pointed out that the nine mornings on which Herd C gave milk below standard were all during the first ten tests; the milking intervals differed by 4 hours for the first eight tests and by $3\frac{1}{2}$ and 3 hours respectively for the remaining two.

TABLE II.,

Showing, for each month, the average difference in fat-content of morning and evening milk with the average difference between the milking intervals.

Month.	HERD A.		HERD B.		HERD C.		HERD D.	
	Diff. in Fat. Per cent.	Diff. in interval.	Diff. in Fat. Per cent.	Diff. in interval.	Diff. in Fat. Per cent.	Diff. in interval.	Diff. in Fat. Per cent.	Diff. in interval.
April	0·40	3 hours	0·50	2 hours	0·70	4 hours	0·50	2 hours
May	0·40	2 ,,	0·55	1 hour	0·60	4 ,,	0·35	2 ,,
June	0·45	2 ,,	0·30	1 ,,	0·60	$2\frac{3}{4}$,,	0·35	2 ,,
July	0·12	1 hour	0·16	48 mins.	0·28	$1\frac{1}{2}$,,	0·18	2 ,,

It will also be seen that the difference between the morning and evening fat-contents became less as the intervals between milking became more nearly equal. The change is not very striking in this experiment, however, as it is shown also by Herd D, whose milking intervals remained constant.

With regard to the solids-not-fat it was concluded last year that the percentage is generally higher in the morning than in the evening, and that the solids-not-fat, like the fat, tend to increase in amount as the lactation period advances.

This conclusion has been supported as the percentage was usually higher in the morning than in the evening, and tended to increase slightly as the tests went on.

Influence of Locality on the Seed of Scotch Pine.

At the Seventh International Forestry Congress, to which reference was made in this *Journal* in November last (p. 636), a report was presented by Professor Arnold Engler, of Zurich, giving a summary of the results obtained at the Swiss Research Station on the influence of locality on the seed of Scotch Pine. The greater part of the seeds were collected in 1905 and sown in 1906. Since then the seedlings have been planted in different districts of Switzerland. Up to the present the following seeds have been used:—34 samples from Switzerland, 47° lat. N., 1,250 to 6,230 ft. elevation; 5 samples from Alsace-Lorraine, 49° lat. N., 430 to 920 ft. elevation; 1 sample from Rhenish-Bavaria, 49° 30′ lat. N.; 1 sample from Eastern Prussia, 53° 40′ lat. N., Johannisburger Heide; 3 samples from France, 45° lat. N.; 1 sample from Belgium, 50° 54′ lat. N., Forest of Lanaeken; 1 sample from Scotland, Forres, 57° 40′ lat. N.; 5 samples from Sweden, 57° to 66° 35′ lat. N.; 1 sample from Norway, 60° 26′ lat. N.; and 4 samples from Russia, Perm, 55° 29′ to 57° 55′ lat. N.

The seeds were planted at Adlisberg, near Zurich, and at three nurseries at altitudes of 1,480, 2,130, and 3,940 ft. The seedlings were planted out at two years of age at the following experiment plots:—

No. of Experiment.	Station.	Altitude.	Area.	No. of Seedlings.
		Feet.	Acres.	
1	Rheinau	1,210	1·88	8,060
2	Eglisau	1,350	3·43	18,767
8	Kümsberg	1,710	0·77	4,324
3	Bienne (Jura)	3,510	3·72	13,942
7	Scanfs (Haute-Engadine)	5,900	0·47	1,872
6	Celerina	6,100	0·59	1,992
4	Samaden	6,300	1·31	7,050
5	Davos-Schatzalp... ...	6,330	0·67	2,925
	Total ...		12·84	58,932

The principal results obtained may be summarised as follows:—

Variation in the Cone.—(1) In the same district the form of the apophyses varies from one tree to another. On the same tree, the cones of a given year are generally of similar form, but often show divergences. Cones on the same tree have, in general, apophyses of the same form during several successive seasons; but exceptions are common. The *plana, gibba,* and *reflexa* forms of the apophyses have been found in all the regions under observation. The great diversity in the form of cones of *Pinus sylvestris* is the result of a fluctuating variability and is also influenced to a great extent by exterior agencies. The shape of the cone cannot be used for the differentiation of Scotch pine into varieties, races or forms.

(2) It has been proved that the thickness of the apophyses increases very regularly—(*a*) in Sweden, from the centre of the country northwards; and (*b*) in the Alps with increasing elevation. Cones

obtained from the north and from the high Alps have a lower specific weight and are much more difficult to open than those of the lower districts of the centre of Europe.

(3) Neither altitude nor latitude has any influence on the size of cones. Cones collected in the higher parts of the Alps and the Auvergne, as well as in the north of Sweden, are notable for their brighter yellowish colour.

Characteristics of the Seeds.—(1) Seeds from the lower regions of middle Europe are heavier than those of the north or of the high Alpine regions. In general, the weight diminishes with increasing latitude and altitude. With higher latitudes than 60°, and with altitudes above 4,900 ft., the weight of a thousand seeds falls below 93 grains.

(2) Pine seeds collected north of latitude 62°, and above Alpine altitudes of more than 5,200 ft., show a more feeble germinating capacity than seeds from more southern and lower regions. Seeds from the former lose their germinating capacity more quickly than those from other European regions.

(3) The colour of the seed and of its wing is variable for all localities. Generally speaking, seeds from the north and the higher Alpine regions are clearer in colour than those from other regions.

Condition of One to Five-year-old Plants.—(1) In all the stations from 1,300 to 6,200 ft. altitude, the height-growth from seeds coming from the centre of Europe is better than that from those of the north or of the high Alpine regions. Those from Alsace-Lorraine, Rhenish-Bavaria, and the lower districts of the north and centre of Switzerland show the best growth. With rare exceptions, the energy of growth of the young pines falls off with increasing latitude and altitude of the mother-trees. This is particularly the case with the Swedish pines.

(2) When cultivated in the less elevated districts, the pines from all regions begin to grow at practically the same time in spring, but, on the other hand, the cessation of growth takes place with the North Swedish and high Alpine pines about ten days earlier than with any others. When cultivated in the higher districts, the high Alpine and the northern pines shoot earlier and finish their growth appreciably earlier than those of the lower regions of Central Europe.

(3) In the high districts, the pines coming from the lower regions of the centre of Europe have suffered from snow, early frosts, and strong insolation. The high Alpine and the northern pines have grown the best up to the present. Pines of the lower regions planted 30 and 50 years ago in Haute-Engadine, can be sharply distinguished from those reproducing themselves naturally. The former show a feeble rate of growth, with short crooked stems, while the latter are tall and straight.

Pines from the north of Sweden and the high Alpine regions, when cultivated in the lower altitudes, have for the most part a bushy and irregular appearance.

(4) The needles of the young pines from the high Alpine regions and from the north, and also those from the south of France, are characterised by their shortness. Their strongly developed cuticle renders them more resistant. The pines of the lower regions of

Central Europe and of the south of France are much richer in resin than those of the north, of Eastern Europe and of the higher regions.

(5) In winter, all the pines assume a more or less yellowish appearance. Those of the north of Sweden and the high Alpine regions show the most coloration, those of the south of France the least. With the Scandinavian pines this coloration is, however, more intense than further north. The point of the needle is chiefly affected. The sides of the needle turned towards the ground, and those needles which are entirely in the shade remain green and are only slightly coloured. If such plants are removed to a hot-house, the needles become green again, showing that the external agents producing coloration in winter are the low temperature, and, in consequence, the insufficient absorption of water to compensate for the relatively strong transpiration.

(6) The leaf-shedding disease (*Schütte*) has been observed on all varieties of the pine. Plants grown from seed gathered in the mountains have suffered principally in this respect, but, on the other hand, the Scandinavian and the French pines have generally escaped. The last-named are characterised by their dark green colour and thick foliage.

OFFICIAL NOTICES AND CIRCULARS.

Report on the Manuring for Mutton Experiments.

The well-known experiments in the manuring of poor pasture land, designed in the first instance by Professor Somerville, were commenced in 1896 under his supervision at the Northumberland County Demonstration Farm at Cockle Park. In 1898, Professor Somerville submitted to the Board of Agriculture and Fisheries a preliminary report which showed the necessity for further experiments on similar lines, and in the following year the Board approached several public bodies with a view to the organisation of experiments in different parts of Great Britain. Eventually arrangements were made with the Bath and West and Southern Counties Society, the Highland and Agricultural Society of Scotland, and the Agricultural Department of the University of Cambridge, by which those bodies agreed to undertake the further experiments required, a substantial contribution being made by the Board towards the expenditure entailed. The aggregate sums paid by the Board for the purpose during the past ten years have amounted to £2,055, in addition to which the Board have made an Annual Grant towards the general expenses of maintaining the Cockle Park Experiment Station.

The result of these experiments has shown that the conclusions which were drawn from the original Cockle Park experiment, and the recommendations made, are applicable to very large areas of pasture land in this country.

Up to the present, however, though these results have been communicated to the public through the medium of separate Bulletins issued by the Institutions carrying out the experiments, no general summary or review of the trials as a whole has been available.

The Board of Agriculture and Fisheries therefore suggested to

Professor Somerville that it would be desirable that he, as the author and originator of these experiments, should prepare a Report which would bring together in one publication the results obtained during the last fourteen years. This Report is issued as a Supplement to the present number of the Journal, price 4*d.*, post free. It is supplied to subscribers without extra charge.

Bulletins of the International Institute of Agriculture.

With reference to the notice which appeared in the December issue of this *Journal* (p. 760) as to the Bulletins of the International Institute of Agriculture, the Permanent Committee of the Institute has now decided to arrange for the sale of these publications to the public at the following subscription rates as from January 1st, 1911:—

Monthly Bulletin of Economic and Social Intelligence, 18 francs.

Monthly Bulletin of Agricultural Intelligence and Diseases of Plants, 18 francs.

Monthly Bulletin of Agricultural Statistics, 6 francs.

Combined subscription for all three publications, 36 francs.

At the same time the Institute is disposed to consider proposals for exchange with reviews and newspapers where the publications offered are of equal importance to these Bulletins and are likely to be of use to the Institute. Persons at present receiving these Bulletins in exchange, or desiring so to receive them in the future, are asked to indicate to the Institute:—

(*a*) the name of the publication or publications that they already send, or which they desire to exchange; and

(*b*) the name of the publication or publications of the Institute that they already receive.

Starting from the date mentioned above, some special sheets, which are not incorporated in the body of the text, and are exclusively devoted to agricultural advertisements, will be inserted in the various Bulletins. The Institute will not accept any responsibility in regard to anything contained in the advertisements.

All communications concerning the subscriptions, exchanges or advertisements should be addressed to the *Institut International d'Agriculture, Bureau du Secrétariat Général,* Rome.

Premiums for Thoroughbred Stallions.

A Show of Thoroughbred Stallions will be held on March 7th next in connection with the Annual Show of the Hunters' Improvement Society, at which the Board of Agriculture and Fisheries will be in a position to offer fifty King's Premiums of an average value of £150 each, out of grants from the Development Fund.

The total value of the premiums will be made up as follows:— Fifty guineas, payable on the award of the premium; service fees, payable after the close of the season for service; and foal fees, payable in the following year.

As already announced, his Majesty the King has been graciously

pleased to signify his intention to offer a Cup for the champion stallion at the above Show, the Cup to be held by the winner for one year.

The rules and conditions under which the King's premiums are to be granted will shortly be issued, and these will contain particulars as to the nineteen districts which will form separate District Classes for the purposes of this Show, and the number of premiums to be allotted in each District Class.

The precise conditions of the competition for his Majesty's Cup will be made public at the same time.

Further information as to the Grants for the promotion of light horse breeding is given on p. 841.

MISCELLANEOUS NOTES.

Importation and other Regulations.

Importation of Plants, &c., into Peru.—The Board have received through the Foreign Office a copy of a Peruvian Law (No. 1221 of December 31st, 1909) which prohibits the importation into the Republic of all plants, shrubs, seeds, and cuttings unless accompanied by a declaration of the sender, together with a certificate issued by the competent authority of the country of origin and attested by the Peruvian Consular Agent to the effect that the plants in the region of origin are immune from disease. The Peruvian Ministry of Commerce is empowered to take measures to secure the immunity of the imported plants, &c., from disease on their entry into the Republic.

A Presidential decree of September 30th, 1910, provides that where the value of the plants, &c., imported does not exceed £1 (Peruvian gold) the attestation of the Peruvian Consular Agent in the country of origin, required by the above law, shall be issued free of charge.

Agricultural Exhibitions Abroad.

Agricultural Exhibition at Bangkok, Siam.—H.M. Acting Consul at Bangkok has forwarded particulars of an exhibition to be held by the Siamese Ministry of Lands and Agriculture at that town. The exhibition will open on April 3rd, 1911, and the exhibits will include vegetables, fruit, live stock, and agricultural machinery. Intending exhibitors should apply to the President of the Committee of the Exhibition at the Ministry of Lands and Agriculture, Bangkok, before February 12th.

Notes on Agriculture Abroad.

Live Stock in Canada.—The Canadian Census and Statistics Bulletin issued in December, 1910, contains particulars of the number and condition of live stock in November, 1910, compared with the preceding year. For the whole of Canada the increases in the number of live stock are as follows:—Horses, 3·31 per cent.; milch cows, 1·13 per cent.; swine, 2·11 per cent.; poultry, 8·02 per cent. The number of sheep has decreased by 1·55 per cent., and the number of live stock other than milch cows has decreased by 2·20 per cent.

By the standard condition of live stock is meant a "healthy and

thrifty state"; and taking this condition as represented by 100, it is this year a fraction over for horses, milch cows, and poultry, and a little under for sheep, swine, and horned cattle other than milch cows.

Cauliflower Cultivation in France.—Some interesting information has been forwarded by H.M. Vice Consul at St. Malo regarding the cultivation of cauliflowers in that district. Cauliflowers usually follow early potatoes, the varieties planted being known as "Choufleur de Naples" for the bulk of the crop, and "Choufleur d'Alger" for the earlier marketing. In 1910 the prices were from 4*s.* to 8*s.* per 100 heads, but on the occurrence of a frost in the United Kingdom these prices are stated to have risen from 16*s.* to 20*s.* per 100 heads. A good cauliflower crop is thus almost as valuable as the preceding potato crop. The land under cultivation is planted by hand in July after a single ploughing, and is hand and horse-hoed. As evidence of the profitableness of the industry, the larger farmers are stated to be constantly buying land.

Opening for Seed Potatoes in Monte Video.—A report of H.M. Vice-Consul at Monte Video, forwarded by the Board of Trade, states that there is a very considerable market for good seed potatoes in that country. At present the bulk of those imported come from France, being in some cases described as grown from English seed. Should the first imports of English seed potatoes prove satisfactory, a considerable trade would probably develop. The name of an individual desirous of importing seed potatoes from the United Kingdom may be obtained on application to the Commercial Intelligence Branch of the Board of Trade, 73 Basinghall Street, E.C.

The Roquefort Cheese Industry.—Roquefort cheese, which is widely renowned for the remarkable delicacy of its flavour, is made from the milk of ewes fermented at a temperature of about 45° F. Analyses made at Roquefort during twenty years show that the composition of this milk is as follows:—Casein, 5 per cent. to 8 per cent.; fatty substances, 6·5 per cent. to 11·5 per cent.; lactose, 4 per cent. to 5 per cent.; mineral salts, 0·8 per cent. to 1·2 per cent.; water, 76 per cent. to 84 per cent. The cheese is unpressed, and of a fatty consistency, and derives its name from its being manufactured in the caves near the village of Roquefort in the Department of Aveyron. The industry is over 2,000 years old, and the cheese is mentioned by Pliny the elder as enjoying a great popularity with the Romans. Towards the end of the seventeenth century about 5,000 cwt. were manufactured annually, but by 1908 this amount had grown to 180,000 cwt., representing in value £1,200,000. The supply of milk is furnished by 450,000 ewes in the seven months December to July of each year. The manufacture of this large amount takes place in some 400 factories within a radius of fifty miles from Roquefort, and the cheeses are now brought to Roquefort solely for ripening and preserving. (*L'Industrie Laitière,* October 23, 1910.)

Mouse Plague in Bavaria.—A serious plague of mice has occurred in Bavaria. The first indication of the pest was its appearance in considerable numbers in the spring of 1910 in Lower Franconia and the western parts of Middle Franconia and Swabia. In spite of the unfavourable weather experienced during the summer, the plague spread eastwards over Bavaria, until only the district in the extreme

east was free from the calamity. The Royal Agricultural and Botanical Institute at Munich has urged upon agriculturists the need for stringent measures, and up to October 1st, 1910, had distributed rat virus prepared by the Institute sufficient for 150,000 acres of land, and poisoned grain and barium carbonate for another 50,000 acres. The measures for the destruction of the mice have, according to the *Praktische Blätter für Pflanzenschutz* (October, 1910), reached proportions never before equalled in Germany. Over 400 parishes have taken action in common against the pest. The best results have been obtained from the use of the Institute's virus, which has an additional recommendation in being cheaper than poisoned grain.

Recently fumigation has also been tried, but preliminary tests have not been favourable to its adoption on a large scale. Further experiments are, however, to be carried out by the Institute at Munich.

Horse Breeding in Poland.—H.M. Consul at Warsaw (Mr. Clive Bayley) states that the Champion Cleveland Bay Stallion of the Yorkshire Agricultural Society's show at Leeds has been purchased by a large Polish breeder, and other purchases in Poland of thoroughbred stock from England are also reported. High prices were realised for horses in that country throughout 1910 owing to the large demand from Germany.

Report on Agricultural Conditions in Great Britain on January 1st.

The "Monthly Agricultural Report" issued by the Board of Agriculture and Fisheries on January 9th gives the following general summary of agricultural conditions in Great Britain :—

The Crop Reporters of the Board, in reporting on the state of the crops and the agricultural conditions on January 1st, refer to the very wet weather prevailing during the month, particularly in England and the extreme north of Scotland. In many districts of England, in fact, there were severe floods, the effect of which is difficult to gauge, though it is feared that some of the wheat may have rotted, and some areas may have to be resown. Where the land has not been flooded, such of the new wheat as was sown early appears generally fairly satisfactory, but the later sowings are backward and sometimes weakly. In Scotland the wheat looks well.

The unfavourable weather hindered all autumn cultivation, and scarcely any progress was made, except in southern and central Scotland. Of the area intended for wheat, something over 80 per cent. is reported to have been sown by January 1st, as compared with about three-fourths on December 1st; but greater advance was made in Scotland than in England. Comparing the actual breadth sown at the end of the year, it would seem that there is an increase of 6 or 7 per cent. in the total area as compared with 1909, while on December 1st the increase over 1909 was about 10 per cent. The difference in the weather conditions in the two Decembers is indicated by this decline. In Wales a considerably smaller area is stated to have been put under wheat this year, and in England the increase is more marked than in Scotland.

"Seeds" are in most districts a full plant and look well, though in many counties patchy areas are to be found here and there.

Turnips and swedes, where lifted, are mostly satisfactory in quality, though in certain districts the excessive wet has been deleterious, and in a few localities some roots have rotted.

Where lambing has already commenced, results are not on the whole very satisfactory. Among the Dorset Horn sheep, while there appear to have been fewer casualties and more twins than usual in East Dorset, in other districts twins seem less numerous, and considerable mortality among the lambs was feared. In all parts of the country ewes have generally suffered from the very wet weather, and their condition cannot be described as satisfactory; this also applies to other sheep, especially those on arable farms.

Notes on the Weather in December.

During the *first* week (November 27th to December 3rd) the weather generally was very dull and unsettled, with frequent rain, though in the north of Scotland cold and bright weather was experienced with "very abundant" sunshine. "Very heavy" rainfall was recorded over England, except in England S.W., where it was "heavy," and N.W., where it was "moderate." Temperature was below the average, being "moderate" in England E. and Scotland E., and "deficient" elsewhere.

The conditions in the *second* week continued generally dull and rainy. "Unusual" warmth prevailed over Great Britain, except in Scotland W., though the amount of bright sunshine was generally either "scanty" or "very scanty." Rainfall varied a good deal in different parts of the country.

The weather during the *third* week was still generally rough and squally, and rain was of daily occurrence in almost all parts, the rainfall being largely in excess of the average. Temperature was very high for the time of year, the excess amounting to 9° in England E.; the districts enjoying "very unusual warmth" were England E., S.E., S.W., and the Midland Counties, and "unusual" warmth was experienced elsewhere. Bright sunshine was less than the normal in all districts.

Much drier weather prevailed during the *fourth* week than during the earlier part of the month, except in Scotland N. Rainfall was "moderate" except in England N.E., where it was "light," and Scotland N., where it was "heavy." Warmth was again either "unusual" or "very unusual" over the country, temperature continuing from 4° to 6° in excess of the average in most districts. Bright sunshine was more than the normal generally, equal to it in England S.E. and S.W., and rather less in the English Channel.

The general condition during the *fifth* week (December 25th to December 31st) was unsettled, but many bright periods were experienced in most parts of the country. Temperature, though above the average in most districts, was everywhere classed as "moderate." Rainfall was either "moderate" or "light," and was less than the average in all districts except Scotland N.; several districts experienced showers of snow and sleet. Sunshine just equalled the average in England E., but exceeded the normal elsewhere, being "very abundant" in Scotland E., and "abundant" over England with the exception of England E. and S.W.

Notes on Crop Prospects Abroad.

The International Institute of Agriculture, in its Bulletin for December, 1910, publishes some additions to, and revisions of, the figures reported in the November Bulletin, which were summarised in this *Journal* for last month. These are as follows:—

Production of Cereals in 1910, compared with 1909.

Country.	Wheat.		Rye.		Barley.		Oats.	
	1,000 cwt.	Per cent.	1,000 cwt.	Per cent.	1,000 cwt.	Per cent.	1,000 cwt.	Per cent.
Germany ...	75,988	102·8	206,845	92·6	57,126	83·0	155,468	86·6
Denmark ...	2,263	112·1	—	—	—	—	13,168	91·3
United Kingdom	31,189	92·1	—	—	28,909	94·0	61,909	99·5
Russian Empire	415,929	98·3	434,207	96·9	196,889	96·9	299,106	89·3
Sweden ...	4,028	108·8	12,272	98·4	6,665	111·5	25,357	109·9
Japan ...	12,694	106·3	—	—	38,416	101·9	—	—

After making allowance for these additions and corrections, the totals for the countries in the Northern Hemisphere shown in the tables given in last month's *Journal* (p. 773), are as follows:—

Wheat.—The area cultivated this year (224,211,000 acres) is 106·5 per cent. of last year's area (210,587,000 acres). The total production this year (1,687,326,000 cwts.) is 99·3 per cent. of last year's production (1,699,000,000 cwts.).

Rye.—The area cultivated this year (98,114,000 acres) is 99·4 per cent. of last year's area (98,665,000 acres). The total production this year (752,701,000 cwts.) is 96·1 per cent. of last year's production (783,307,000 cwts.).

Barley.—The area cultivated this year (62,948,000 acres) is 102·5 per cent. of last year's area (61,416,000 acres). The total production this year (552,245,000 cwts.) is 94·2 per cent. of last year's production (586,300,000 cwts.).

Oats.—The area cultivated this year (127,269,000 acres) is 102·2 per cent. of last year's area (124,509,000 acres). The total production this year (1,125,522,000 cwts.) is 93·6 per cent. of last year's production (1,201,904,000 cwts.).

Maize.—The area cultivated this year (135,679,000 acres) is 103·8 per cent. of last year's area (130,722,000 acres). The total production this year (1,817,387,000 cwts.) is 113·4 per cent. of last year's production (1,603,147,000 cwts.).

The Institute has also received estimates of the cereal production of 1910-11 from several countries of the Southern Hemisphere. As regards wheat, these estimates are as follows:—

COUNTRY.	AREA.		PRODUCTION.	
	1909–10.	1910–11.	1909–10.	1910–11.
	Acres.	Acres.	Cwt.	Cwt.
Argentina	14,416,000	15,445,000	70,165,000	70,843,000
Chile	1,433,000	2,258,000	12,594,000	19,336,000
New Zealand ...	311,000	280,000	4,639,000	3,749,000

Potato Crop of Germany.—The following particulars as to the acreage and production of potatoes in Germany have been issued by the German Imperial Statistical Bureau :—

	Area. Acres.	Production. Tons.	Yield per acre. Tons.
1910	8,142,000	42,770,000	5·25
1909	8,210,000	45,956,000	5·60
1908	8,133,000	45,598,000	5·61

Russia.—According to a dispatch dated December 27th, received from H.M. Consul at Odessa (Mr. C. S. Smith) the general average condition of the winter crops in the middle of December was thought to be above medium. Unsatisfactory reports are confined to small and scattered areas.

The Board of Agriculture and Fisheries have been furnished by the Board of Trade with the following report, based on returns from correspondents in various districts, on the demand for agricultural labour in December :—

Agricultural Labour in England during December.

Labourers who were not attached to the staffs of farms were generally in somewhat irregular employment during December, particularly in the Midland and Southern and South-Western Counties, on account of the excessive rainfall. Such men were chiefly wanted for threshing, hedging, and ditching, draining, manure-carting, and work on the root crops, but the demand was rarely large, while the supply of men was ample, a surplus being reported in many districts. Men for permanent situations were reported to be somewhat scarce in Oxfordshire and in several districts in the Southern and South-Western Counties. In Cumberland, on the other hand, the supply of men for permanent situations was stated to be in excess of the demand.

Northern Counties.—There was only a small demand in these counties for men in addition to the regular staff hands, on account of seasonal slackness in farm work; the employment of such extra men was also rendered irregular during the first part of the month by wet weather. The supply of extra men was reported as greater than the demand in many districts in *Yorkshire*. In *Cumberland* a surplus of men for permanent situations was reported. Where employed, extra men were chiefly engaged for turnip-pulling, threshing, hedging, and ditching.

Midland Counties.—Continuous wet weather kept extra labourers in irregular employment for a large part of the month in most of the districts reported on, the rain causing considerable interruption to such work as threshing and manure-carting. There was an ample supply of extra labourers in all the districts except in the Wing Rural District in *Buckinghamshire,* where a correspondent stated that men could not be obtained for draining the land; a surplus of extra men was reported in the Melton Mowbray (*Leicestershire*), Seisdon and Tamworth (*Staffordshire*), Shipston-on-Stour (*Worcestershire*), Thame and Crowmarsh *fordshire*), Thame and Crowmarsh (*Oxfordshire*), and Buckingham (*Buckinghamshire*) Rural Districts. Some scarcity of men for permanent situations was reported from *Oxfordshire.*

Eastern Counties.—There was generally some demand for extra labourers in these counties on account of such work as threshing, hedging, ditching, draining, and manure-carting, and employment on the whole was fairly regular for these men. The supply of and demand for extra labourers were about equal in most districts; an excess was reported in the Ely (*Cambridgeshire*), Samford (*Suffolk*), and Braintree (*Essex*) Rural Districts, while in the Welton (*Lincolnshire*) Rural District there was a scarcity of such men.

Southern and South-Western Counties.—Extra labourers lost a good deal of time, particularly in the more western counties. They were chiefly employed at hedging, ditching, draining, threshing, manure-carting, and root-storing, but the demand for extra men to perform such work was generally only moderate. A surplus in the supply of extra men was reported from the following Rural Districts:—Hollingbourne, Hoo, and West Ashford (*Kent*), Hartley Wintney and Havant (*Hampshire*), Bradford-on-Avon, Westbury, and Devizes (*Wiltshire*), Hereford (*Herefordshire*), and South Molton (*Devon*). Men for permanent situations were reported as scarce in the Godstone (*Surrey*), Petworth (*Sussex*), Williton (*Somerset*), Newton Abbot (*Devon*), and Camelford, Truro, and West Penwith (*Cornwall*) Rural Districts.

THE CORN MARKETS IN DECEMBER.

C. KAINS-JACKSON.

Wheat.—The average price of British grain for the first four months of the cereal year was found on New Year's Day to have been 30*s.* 6*d.* per qr., that for the like period of the previous cereal year having been 33*s.* per qr. The sales showed about ten per cent. diminution, though the quality and condition of the 1910 (Sept.-Dec.) deliveries were rather superior to the quality and condition of the 1909 deliveries in the similar period of that year. Despite the smaller deliveries, stocks of British wheat at the New Year were less than on January 1st, 1910, for the total crop yield was materially less. Imported wheat in December sold very badly; it was only in the three last days that sales reached anything like a winter level. Not only did we have a Green Christmas, but the weather leading up to it was wholly against a brisk demand, either for bread or meal. The sorts which kept up best in price were Canadian, American Spring, Argentine, and fine North Russian, a medium position being occupied by American Winter, Australian, and Indian. The sorts which were most difficult to place were ordinary South Russian, soft New Zealand, and Californian, and the supplies from S.E. Europe other than Roumania, whence a small supply of rather better quality than usual has come to hand.

December shipments were 808,000 qrs. from North America, 525,000 from South America, 2,957,000 from Russia, 984,000 from Europe S.E., 397,000 from India, and 219,000 from Australia. These exports included 170,000 qrs. of new crop from Argentina, and 86,000 qrs. from Australia. The supply on passage on December 31st was 1,995,000 qrs. Prices ruling at Mark Lane as the year closed were 30s. to 34*s.* 6*d.* per 504 lb. for English wheat, 34*s.* to 38*s.* per 480 lb. for Canadian, 35*s.*

to 37*s*. for American, 36*s*. to 37*s*. for Argentine, 37*s*. to 38*s*. for Australian, 29*s*. to 36*s*. per 496 lb. for Russian.

Flour.—Though the imports for the period September 1st to December 31st were smaller than for the like four months of 1909, prices showed little sign of hardening for foreign types. London mills lowered their pretensions to 32*s*. for top-price flour, and from the 16th to 23rd December accepted 26*s*. 9*d*. cash for Town Households. On the 30th the price for Household flour was "a firm 27*s*.," and other London sorts, such as Town Whites, No. 2, &c., were held for 3*d*. to 6*d*. advance. Country flour has not been a good sale, nor have the by-products of the mill moved off at all well. The latter circumstance is attributed to the open character of the weather. The shipments of flour from North America in December were 604,000 sacks, the Canadian contribution being larger than usual. There were 240,000 sacks on passage on 31st ult., Canada and the Adriatic being well represented, the U.S.A. showing rather under an average figure, while Argentina and Russia were scarcely contributories. Oversea competition with British mills in 1910 showed no increase of pressure.

Barley.—A large trade has been done in medium qualities of British and in inferior Russian grinding corn, but maltsters have been inactive, and the business done in the two sorts indicated has been induced only by the offer of the grain at depressed prices. British is, on the four completed months of the cereal season, 2*s*. 2*d*. down, and 18*s*. 3*d*. to 18*s*. 9*d*. per 400 lb. for Russian is not much over a halfpenny per lb., a quotation which for any ordinary feeding stuff seems nowadays to attract an immediate demand. Shipments of barley for December included 2,178,000 qrs. from Russia, 416,000 from Europe S.E., and 214,000 from the U.S.A. The supply on passage on 31st ult., 775,000 qrs., comprised 600,000 qrs. Californian brewing; 125,000 qrs. Russian and S.E. European grinding; and 40,000 qrs. Anatolian, mainly brewing and steeping barley. The price asking for fine malting at the end of the year was about 36*s*. for good English, but special lots from Hungary touched two sovereigns per quarter.

Oats.—Imports have not been heavy, and home supplies have been light, so that the depression in this staple is commonly attributed to the superior attractions of cheap maize. The markets made a net advance of 2*d*. per qr. during December, but 14*s*. still commanded Russian and Argentine f.a.q., 18*s*. British and Prussian. The December shipments included 1,643,000 qrs. from Russia, and 154,000 from Argentina; the last-named country was doing on the 29th, 30th, and 31st a good business in new crop for direct shipment to London in February at 13s. per qr., a price which, while not depressing spot values, obviously opposed an obstacle to material advance.

Maize.—Argentina in December sent off 1,416,000 qrs., but the price asked, 21*s*. to 21*s*. 3*d*., proved attractively low, and the month closed with 22*s*. 6*d*., obtained off stands. America shipped 150,000 qrs. of her new crop in the few trading days between Christmas and the New Year. About a halfpenny per lb. has been the price for large cargoes of the new American, and there is for the first few months of 1911 at all events, a fair promise of sound feeding maize of the flat and mixed kinds at three shillings per bushel to the smaller buyers. This quotation should be helpful to farmers, horse and stock, and also poultry owners.

The quantity on passage on 31st ult. was 910,000 qrs., most of it yellow corn. The American surplus is put by *Beerbohm's List* (December 30th) at 44,000,000 qrs. more than that of the previous year, but the agricultural Press expects large quantities to be absorbed in the feeding of an increased number of pigs and in American stock feeding generally.

Oilseeds.—Owing to unfavourable reports of the linseed yield in Argentina the market for that oilseed advanced half a crown per qr. in the last few days of the Old Year. India is expected, according to the market advices, to yield 50,000 tons more linseed than last season, against Argentina's 25,000 tons less, but the imports of the United Kingdom in 1910 are stated to have been fully 100,000 tons below requirements, and stocks to be accordingly very reduced. The good crop of cottonseed secured in Egypt during October has now come to hand in very fair quantity, and prices in mid-December fell to 7*s.* 6*d.* per cwt. Buyers acted so promptly, however, that 8*s.* 3*d.* was asked as the month closed, which it did with only 34,000 qrs. of linseed and 43,000 tons of cottonseed on passage, against 57,000 qrs. and 61,000 tons a twelvemonth previously.

Various.—Among prices asked for fair average quality samples on the last day of 1910, the following quotations may be mentioned:—English beans, new crop, 32*s.* per 532 lb.; Indian white peas, 30*s.* per 504 lb; Indian chick peas, 25*s.* per 504 lb.; Burmese Dari, 22*s.* 6*d.* per 480 lb.; Essex rye, 24*s.* per 480 lb.; Norfolk buckwheat, 27*s.* per 416 lb.; Midlothian oatmeal, 34*s.* per 280 lb. sack; Canadian oatmeal, 22*s.* per 240 lb. sack; barley meal, 12*s.* 6*d.* per 240 lb. sack; maizemeal, 12*s.* per 240 lb. sack; feeding rice, 7*s.* 6*d.* per cwt.; and German beet sugar, 9*s.* per cwt.

THE LIVE AND DEAD MEAT TRADE IN DECEMBER.

A. T. MATTHEWS.

Fat Cattle.—The chief interest of the month's trading centred in the Christmas markets, as there was a general expectation of a revival in the demand for British beef which had been gradually shrinking for many weeks. Unfortunately these hopes were doomed to disappointment, and at the majority of the great markets prices barely equalled those of last year. The change in the character of the cattle on offer on these occasions, so noticeable of late years, was more marked than ever, and overfed beasts of great size are now conspicuous by their absence. At some country markets prize animals fetched fancy prices for purposes of advertisement, a few Shorthorns making £40 and upwards.

The Metropolitan Christmas market was typical of most others, with a moderate supply of excellent quality, being composed of ripe but neat animals of handy weight, and very little superfluous fat. Yet, though there were only 2,300 head on offer, against 2,900 last year, business was rather dragging, and a clearance barely made. The extreme price of Aberdeen-Angus steers was 8¼*d.* per lb., and none exceeded £30 per head. There was a splendid show of Devons,

the best making $7\frac{3}{4}d.$ per lb., and some were sold at £35 each. Herefords, Shorthorns, and Welsh made only a moderate display. The average prices for cattle in English markets for the whole month were:—Shorthorns, 8*s.* 1*d.*, 7*s.* $3\frac{3}{4}d.$, and 6*s.* 5*d.* for first, second, and third quality; Herefords, 8*s.* $2\frac{1}{2}d.$ and 7*s.* $6\frac{3}{4}d.$; Devons, 8*s.* $3\frac{1}{2}d.$ and 7*s.* 7*d.*; Welsh Runts, 8*s.* and 7*s.* $5\frac{1}{2}d.$; and Polled Scots, 8*s.* 2*d.* and 7*s.* 7*d.* per 14 lb. stone. Comparing these figures with those of November, and taking first quality only, we find that Shorthorns declined $1\frac{3}{4}d.$ per stone; Herefords, 3*d.*; Devons, $2\frac{1}{2}d.$; Welsh, $1\frac{1}{2}d.$; and Scots, $1\frac{1}{4}d.$ As the enhanced prices at the Christmas markets were included in the above, it is obvious that the general tendency was very distinctly downwards.

Veal Calves.—Veal is only in small demand at this season, but supplies were none too large, and prices were well maintained, and, indeed, slightly higher than in November. The average in about eighteen British markets was $8\frac{3}{4}d.$ and $7\frac{1}{2}d.$ per lb. for first and second quality.

Fat Sheep.—Since the commencement of the turnip season the weather has been unfavourable, at least, during December. Constant rains have kept the sheep's coats sodden and the folds muddy, conditions under which sheep cannot thrive. This may have kept supplies back, and partly explain an advance in values rather unusual in December. The averages for Downs in the English markets were $8\frac{1}{4}d.$, $7\frac{1}{4}d.$, and $5\frac{1}{2}d.$ per lb., with a fraction over; Longwools, $7\frac{3}{4}d.$, 7*d.*, and $5\frac{1}{4}d.$ The total advance on the November averages was just over $\frac{1}{4}d.$ per lb., which is a distinct and very welcome improvement. In the third week Downs were quoted at 9*d.* per lb. at Derby, London, Newcastle, and Salford, while at Wellington (Salop), $9\frac{3}{4}d.$ was reported. There is no doubt that a small allowance should be made for the increasing value of skins as the season advances, but it is evident that a very much better tone has prevailed in the sheep trade during the last two weeks of the year.

Fat Pigs.—Bacon pigs continued to decline in value till the last week, when there was a rally in the trade, but the average for the month in about thirty British markets was only 7*s.* 4*d.* and 6*s.* 9*d.* per 14 lb. stone, against 7*s.* 7*d.* and 7*s.* in November, and 8*s.* 2*d.* and 7*s.* 7*d.* in August. A further decline is not considered likely at present, in view of the restricted supplies from America and the statistical position at home.

Carcass Beef—British.—Scotch beef declined in the early part of the month, but the quality was not then very fine. The Christmas supplies were moderate and of choice quality, and there was a stiff advance on ordinary rates with a good clearance. Short sides fetched up to $7\frac{1}{2}d.$ in the great Christmas market at Smithfield, but the month's average was lower than in November. Short sides averaged $6\frac{1}{2}d.$ to 7*d.*; long sides, $6\frac{1}{4}d.$ to $6\frac{1}{2}d.$; and English, $5\frac{3}{4}d.$ to $6\frac{1}{8}d.$ per lb.

Port-killed Beef.—American Deptford-killed beef averaged $5\frac{3}{4}d.$ and $5\frac{1}{2}d.$ per lb. for first and second quality, but special consignments of unusually good animals arrived for Christmas, and fetched just about the same as English in the Central Market.

Chilled Beef.—Argentine deliveries were moderate and quite small in the last week; therefore, much better prices were made. Best hind-

quarters touched $4\frac{3}{4}d.$ per lb., and averaged $4\frac{1}{4}d.$ for the month. Best forequarters averaged $3d.$ per lb. Best States hindquarters averaged $6d.$, and forequarters $3\frac{3}{4}d.$ per lb.

Frozen Beef.—Frozen beef from Argentina and the Colonies averaged $3\frac{3}{8}d.$ per lb. for best hindquarters.

Carcass Mutton—Fresh Killed.—The first two weeks' trade remained dull at about November prices, but greatly improved as the month advanced, and prices were $\frac{1}{2}d.$ per lb. higher at the finish. Prime small Scotch averaged $7\frac{1}{4}d.$ per lb.; second quality, $6\frac{3}{4}d.$; English, $6\frac{3}{8}d.$ and $5\frac{7}{8}d.$; and Dutch, $6\frac{1}{8}d.$ and $5\frac{1}{2}d.$ per lb. There is a visible increase in the trade in small Scotch carcasses in London, weighing 40 to 44 lbs.

Frozen Mutton.—The trade in Argentine and Colonial mutton has been steady at very similar prices to those of November. Best "Canterbury" averaged $4\frac{1}{2}d.$ per lb. Best Argentine averaged $3\frac{1}{2}d.$ per lb.

Carcass Lamb.—Demand for frozen lamb has continued remarkably good, and shows a further advance in values. Prime New Zealand averaged $6\frac{1}{4}d.$ per lb., and Australian $5\frac{5}{8}d.$, in London.

Veal.—English veal was dealt in only to a small extent, but prices were very fair for the time of year. The London average was $8d.$ per lb. for first, and $7d.$ for second quality.

Pork.—Beginning slow, the trade greatly improved at Christmas, and closed at the high value of $8d.$ per lb. for small, and $7d.$ for larger porkers. The average for the month in London was $7\frac{1}{2}d.$, and $6\frac{3}{4}d.$ per lb. for English pigs.

THE PROVISION TRADE IN DECEMBER.

HEDLEY STEVENS.

Bacon.—The year 1910 will long be remembered by all dealers in hog products as a most unsatisfactory period, caused by the continued small arrivals from almost all countries, resulting in very extreme prices, and in consequence a great falling off in the consumptive demand. In the past, bacon was the food of the masses, but for the greater part of 1910 it has been much dearer than any other meat; and only to keep up their returns partially, both wholesale and retail dealers have had to work at near cost, or at a loss. The producers of the raw material have secured all the profit. The period in which the highest prices ruled was during the months of June and July, but early in August values commenced to recede on most descriptions, and by the end of the year Continental singed sides showed a fall of fully 2d. per lb.

The greatest falling off in supplies has been from the United States of America, and Canda, and though the arrivals from these two countries have somewhat increased during the last few months, they are still much below the average. Advices from America report disappointment at the continued small quantities of hogs marketed, and consequent maintenance of high prices. Many of those best qualified to judge expected a \$6 hog by the end of the year, but they were only just under \$8. From reliable statistics it appears that there is a large increase in the number of young hogs in the country, and it is now thought that we may expect the larger numbers to be marketed during

February and March, with the lower-priced product to follow. Shipments from Denmark during the year have been below those of 1909, but the total weight has been in excess of that received from the United States for the same period. The shipments from Russia are an important feature, these goods largely taking the place of American singed sides, and the cheaper Continental. The arrivals into London some weeks have been around 3,000 bales, or the product of, say, 6,000 pigs. The quality and general appearance continues to improve.

It has been a very trying year for the English curing houses, on account of the difficulty in obtaining sufficient pigs to fill their requirements. However, the profitable prices realised by breeders have brought more into the pig breeding business, and during the last few months supplies have been more free.

Cheese.—There has been a steady trade throughout the month of December, but little change in prices. Holders of Canadian makes, both here and in Canada, look for higher prices in the New Year, in spite of the large make in New Zealand. This branch of the provision trade has also been unprofitable to dealers, though there have not been any serious losses. The producers have again made all the profit, especially in Canada. The fluctuations in prices throughout the year have been unusually small, and at the end of the year prices were about the same as those current at the end of 1909. The estimated stocks of Canadian cheese at the three principal distributing centres (London, Liverpool, and Bristol) at the end of the year, were 404,000 boxes, against 377,000 at the close of 1909, and 368,000 in 1908.

Prices continue high in the United States of America, full cream cheese making, on the New York market, equivalent to 75*s.*, and skims, 60*s.*, landed in England.

There has been a large home make of cheese, conditions throughout the summer being favourable for a good flow of milk, but the wet weather led to irregularities in quality, and in consequence prices have shown a greater range than usual.

Butter.—Though there has been a steady trade during the month no great confidence has been shown by operators, and prices of Colonial and Argentine are about 8*s.* per cwt. down on the month. The arrivals for December from Australia and New Zealand show a large increase over December, 1909 (being nearly 1,500 tons), and large shipments are en route, so that it is anticipated by some that we shall have a reasonable range of prices throughout the winter. Stored stocks have been reduced. Serious losses have been made on imported parcels this year, on account of the manipulation of the market early in the spring, forcing prices up to an abnormal level, which curtailed consumption for butter, and increased demand for margarine.

Prices for December, both in Canada and the United States, were too high to admit of business with this country. In the U.S.A. fancy butter is realising from 1*s.* 4*d.* to 1*s.* 5*d.* per lb.

Eggs.—The demand has been good during December, especially for new laid and best selections of pickled. Prices, which have ruled high throughout the year, show little change on the month. Imports from Canada have again been practically nil, on account of the high prices paid for home requirements.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and SCOTLAND in the Month of December, 1910.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	England. First Quality.	England. Second Quality.	Scotland. First Quality.	Scotland. Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per cwt.†	per cwt.†
Cattle:—	s. d.	s. d.	s. d.	s. d.
Polled Scots	8 3	7 7	40 7	36 9
Herefords	8 3	7 7	—	—
Shorthorns	8 2	7 4	39 3	35 10
Devons	8 4	7 8	—	—
	per lb.* d.	per lb.* d.	per lb.* d.	per lb.* d.
Veal Calves	8¾	7¾	8¾	7
Sheep:—				
Downs	8¼	7¼	—	—
Longwools	7¾	6¾	—	—
Cheviots	8¾	7¾	8½	7¼
Blackfaced	8¼	7	7¾	6½
Cross-breds	8¼	7¼	8¾	7½
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs:—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	7 4	7 0	7 4	6 4
Porkers	8 1	7 7	7 9	6 11
LEAN STOCK:—	per head.	per head.	per head.	per head.
Milking Cows:—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	23 3	19 10	23 1	18 16
,, —Calvers... ...	22 9	19 4	21 0	17 12
Other Breeds—In Milk ...	19 1	15 14	19 19	16 16
,, —Calvers ...	—	—	20 9	16 16
Calves for Rearing	2 6	1 15	2 12	1 16
Store Cattle:—				
Shorthorns—Yearlings ...	10 4	8 17	10 6	8 14
,, —Two-year-olds...	14 7	12 13	14 11	11 18
,, —Three-year-olds	17 0	14 17	16 12	14 10
Polled Scots—Two-year-olds	—	—	14 8	13 9
Herefords— ,,	14 16	13 3	—	—
Devons— ,,	13 5	11 18	—	—
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	36 11	30 1	—	—
Scotch Cross-breds ...	—	—	30 0	24 9
Store Pigs:—				
Under 4 months	27 6	20 7	23 6	18 6

* Estimated carcass weight.
† Live weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND and SCOTLAND in the Month of December, 1910.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Quality.	Birmingham. s.	d.	Liverpool. s.	d.	London. s.	d.	Manchester. s.	d.	Edinburgh. s.	d.	Glasgow. s.	d.
		per cwt.		per cwt.		per cwt.		per cwt.		per cwt.		per cwt.	
BEEF:—													
English	1st	52	6	50	6	57	0	50	0	56	0*	62	0*
	2nd	48	0	47	0	53	0	47	6	49	0*	51	0*
Cow and Bull ...	1st	46	0	44	6	47	0	44	6	44	6	46	0
	2nd	41	0	38	6	42	6	39	6	38	6	36	6
U.S.A. and Canadian:—													
Port Killed ...	1st	51	6	49	0	54	6	49	0	—		52	6
	2nd	46	0	46	6	52	0	46	0	—		46	6
Argentine Frozen—													
Hind Quarters...	1st	32	6	32	6	31	6	32	6	34	0	31	6
Fore ,, ...	1st	28	6	28	0	26	6	28	0	29	0	27	0
Argentine Chilled—													
Hind Quarters..	1st	38	6	34	0	39	0	34	6	38	0	38	6
Fore ,, ...	1st	29	6	27	0	28	0	27	0	28	0	29	0
American Chilled—													
Hind Quarters—	1st	—		—		56	6	—		57	0	—	
Fore ,, ...	1st	—		—		35	0	—		37	6	—	
VEAL:—													
British	1st	—		74	0	73	6	78	0	—		—	
	2nd	65	6	69	0	65	6	71	6	—		—	
Foreign	1st	—		—		73	6	—		76	6	—	
MUTTON:—													
Scotch	1st	—		68	0	68	0	67	6	60	6	66	6
	2nd	—		63	6	63	0	64	0	51	0	48	6
English	1st	63	0	62	6	59	6	65	0	—		—	
	2nd	53	0	58	0	54	6	59	6	—		—	
Argentine Frozen ...	1st	32	6	31	6	33	0	31	6	32	0	32	6
Australian ,, ...	1st	31	0	29	0	30	6	29	0	—		31	6
New Zealand ,, ...	1st	—		—		42	0	—		—		—	
LAMB:—													
British	1st	—		—		—		—		—		—	
	2nd	—		—		—		—		—		—	
New Zealand ...	1st	56	0	53	6	57	6	53	6	—		—	
Australian	1st	52	0	47	0	52	0	47	0	—		45	0
Argentine	1st	50	6	47	0	46	6	47	0	53	6	42	0
PORK:—													
British	1st	75	0	72	6	70	0	73	0	65	0	61	6
	2nd	66	0	67	0	62	6	68	0	55	6	58	6
Foreign	1st	—		—		65	6	—		—		—	

* Scotch.

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1908, 1909 and 1910.

Weeks ended (*in* 1910)	Wheat.						Barley.						Oats.					
	1908.		1909.		1910.		1908.		1909.		1910.		1908.		1909.		1910.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Jan. 1 ...	35	1	32	0	33	3	26	9	26	7	25	1	18	4	17	4	17	4
,, 8 ...	35	2	32	9	33	6	26	9	26	11	24	11	18	3	17	5	17	2
,, 15 ...	35	5	32	8	33	8	27	1	27	1	24	11	18	5	17	5	17	7
,, 22 ...	35	6	33	2	33	9	26	11	27	3	24	11	18	5	17	8	17	6
,, 29 ...	35	0	33	0	33	6	26	11	27	6	25	0	18	4	17	9	17	4
Feb. 5 ...	34	3	33	4	33	7	26	9	27	7	24	10	18	3	17	10	17	7
,, 12 ...	33	1	33	8	33	4	26	9	27	8	24	9	18	0	17	11	17	11
,, 19 ...	32	6	34	1	33	0	26	5	27	11	24	6	17	11	18	0	18	0
,, 26 ...	30	11	34	5	32	7	26	3	28	0	24	2	17	8	18	0	17	10
Mar. 5 ...	30	5	34	10	32	7	26	1	27	11	24	6	17	8	18	2	18	1
,, 12 ...	31	3	35	8	32	6	26	0	28	4	24	1	17	10	18	2	18	0
,, 19 ...	31	7	35	9	32	6	26	2	28	0	23	6	17	11	18	5	18	0
,, 26 ...	31	4	36	0	32	9	25	10	28	0	23	7	17	10	18	6	17	11
Apl. 2 ...	31	3	36	5	33	0	25	5	27	10	23	8	17	9	18	8	18	0
,, 9 ...	31	2	37	4	33	6	25	10	28	0	23	1	17	7	18	10	17	11
,, 16 ...	30	11	38	7	33	7	26	1	27	8	23	5	17	7	19	2	18	3
,, 23 ...	30	10	41	4	33	7	25	5	28	2	23	0	17	9	19	9	18	3
,, 30 ...	31	6	42	5	33	0	25	8	27	10	22	10	18	0	20	0	18	3
May 7 ...	32	4	40	9	32	6	25	5	27	7	22	7	18	4	20	3	18	2
,, 14 ...	33	1	41	6	32	1	24	9	27	3	22	0	18	7	20	6	18	1
,, 21 ...	33	8	42	8	31	10	25	9	27	0	21	8	18	10	20	11	17	8
,, 28 ...	33	5	42	6	31	3	24	6	26	3	21	4	18	8	21	0	17	10
June 4 ...	33	1	43	1	30	2	25	10	25	7	21	8	18	4	21	3	17	10
,, 11 ...	32	7	42	11	29	1	24	5	26	10	20	9	18	4	21	4	17	10
,, 18 ...	32	0	42	7	29	0	24	2	26	10	18	11	18	5	21	6	18	0
,, 25 ...	31	5	42	8	29	4	24	0	27	2	20	1	18	7	21	7	17	9
July 2 ...	30	11	42	9	29	9	23	11	27	2	19	11	18	7	21	9	17	7
,, 9 ...	30	5	43	0	30	4	24	4	26	4	19	5	18	5	21	8	17	4
,, 16 ...	30	7	43	3	31	1	23	1	26	10	21	3	18	5	21	9	17	7
,, 23 ...	31	5	44	0	31	11	26	5	27	4	19	9	18	6	22	5	17	5
,, 30 ...	31	10	43	5	33	5	24	4	24	6	20	10	18	7	22	2	18	1
Aug. 6 ...	31	6	44	9	33	9	23	1	27	4	20	5	18	9	22	11	18	3
,, 13 ...	31	6	44	9	33	5	23	10	24	9	20	4	18	1	21	8	18	0
,, 20 ...	31	2	41	6	32	11	24	5	23	11	20	11	17	10	19	8	17	11
,, 27 ...	30	10	38	5	32	7	24	5	24	7	20	10	17	1	19	4	17	2
Sept. 3 ...	30	10	37	2	32	2	25	5	26	3	22	10	17	3	19	6	17	2
,, 10 ...	31	5	34	11	31	11	25	11	26	1	23	3	17	6	18	5	17	2
,, 17 ...	31	7	33	6	30	11	26	0	26	5	24	3	17	3	17	9	16	6
,, 24 ...	31	5	32	9	30	2	26	8	26	8	24	2	17	2	17	7	16	3
Oct. 1 ...	31	7	32	2	30	1	26	11	26	9	24	4	17	2	17	2	16	4
,, 8 ...	31	5	31	8	30	1	27	5	26	9	24	7	17	0	17	0	16	3
,, 15 ...	31	2	31	4	30	2	27	6	27	0	25	1	17	0	17	0	16	2
,, 22 ...	30	11	31	8	30	4	27	5	27	7	25	3	16	11	16	11	16	1
,, 29 ...	30	8	31	10	30	4	27	5	27	9	25	4	16	11	17	0	16	2
Nov. 5 ...	30	11	32	5	30	4	27	6	27	9	25	6	17	0	17	0	16	2
,, 12 ...	31	2	32	5	29	11	27	4	27	7	25	4	17	0	17	1	15	11
,, 19 ...	31	10	32	7	29	8	27	3	27	0	25	1	17	3	17	4	16	1
,, 26 ...	32	3	33	0	29	11	27	2	26	8	24	10	17	5	17	3	16	4
Dec. 3 ...	32	7	33	3	30	6	27	2	26	1	24	7	17	4	17	4	16	7
,, 10 ...	32	8	33	3	30	9	27	0	25	7	24	3	17	4	17	3	16	9
,, 17 ...	32	9	33	2	30	7	26	9	25	3	23	9	17	3	17	4	16	10
,, 24 ...	32	2	33	1	30	7	26	8	25	2	23	10	17	2	17	4	16	9
,, 31 ...	32	0	33	3	30	5	26	7	25	1	23	9	17	4	17	4	16	9

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

CORN PRICES:—ANNUAL AVERAGES.

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Weekly Averages of Corn Returns from the Returning Markets, together with the QUANTITIES returned as sold at such Markets during each of the Years 1904 to 1910.

YEARS.	PRICES.			QUANTITIES.		
	Wheat.	Barley.	Oats.	Wheat.	Barley.	Oats.
	s. d.	s. d.	s. d.	Quarters.	Quarters.	Quarters.
1904... ...	28 4	22 4	16 4	2,138,142	3,437,176	1,316,516
1905... ..	29 8	24 4	17 4	2,467,551	3,265,613	1,073,611
1906... ...	28 3	24 2	18 4	2,684,101	3,210,995	1,011,931
1907... ...	30 7	25 1	18 10	2,722,847	3,317,521	1,374,260
1908... ...	32 0	25 10	17 10	3,293,506	3,293,916	1,304,223
1909... ...	36 11	26 10	18 11	2,641,225	2,699,628	905,983
1910... ...	31 8	23 1	17 4	3,072,523	3,205,203	791,121

AVERAGE VALUE per IMPERIAL QUARTER OF WHEAT IMPORTED into the UNITED KINGDOM from the undermentioned Foreign Countries and British Possessions in the years 1908, 1909, and 1910.

Countries from which consigned.	Average Value per Imperial Quarter.		
	1908.	1909.	1910.
	s. d.	s. d.	s. d.
Argentine Republic	35 6	39 9	34 11
Chile	35 1	39 1	33 7
Germany	33 7	38 3	36 11
Bulgaria	36 0	—	—
Roumania	38 4	40 9	34 2
Russia	38 3	39 3	35 7
Turkey	36 8	32 4	30 0
U.S. of America	36 2	38 6	37 3
India, British	37 8	40 8	35 5
North America, British	35 2	39 3	36 9
Australia	37 7	41 5	37 2
New Zealand	—	40 6	32 7

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE, BELGIUM, and GERMANY, and at PARIS, BERLIN, and BRESLAU.

—		Wheat.		Barley.		Oats.	
		1909.	1910.	1909.	1910.	1909.	1910.
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
France:	November	39 7	46 2	25 4	25 8	20 4	21 0
	December	39 9	46 7	25 6	25 10	20 8	21 3
Paris:	November	40 3	48 1	24 8	26 0	19 8	21 3
	December	41 1	48 5	24 8	26 2	20 5	21 8
Belgium:	October	35 11	33 7	24 2	22 6	19 5	18 11
	November	36 4	32 3	23 9	22 6	19 6	19 7
Germany:	October	44 1	40 11	27 6	26 8	21 2	20 9
	November	43 7	40 6	27 5	27 11	21 0	20 10
Berlin:	October	47 2	43 1	—	—	21 3	20 3
	November	46 8	43 0	—	—	21 7	20 6
Breslau:	October	44 10	38 5	27 2* 25 1†	25 9* 22 11†	20 4	20 7
	November	44 1	37 9	27 2* 25 1†	26 6* 22 11†	20 4	19 9

* Brewing. † Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*, the prices for the German Empire representing the average of the prices at a number of markets.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of December, 1909 and 1910.

—	Wheat.		Barley.		Oats.	
	1909.	1910.	1909.	1910.	1909.	1910.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
London	34 2	31 4	24 5	23 1	19 1	18 5
Norwich	32 11	30 8	24 4	23 6	17 2	16 11
Peterborough	32 0	30 1	25 8	23 7	16 7	16 6
Lincoln	32 9	30 4	26 2	23 6	17 0	16 6
Doncaster	32 4	30 4	26 1	23 4	17 1	16 5
Salisbury	33 3	30 1	25 10	22 1	17 3	16 3

ERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND and SCOTLAND in the Month of December, 1910.

Compiled from Reports received from the Board's Market Reporters.)

Description.	Bristol.		Liverpool.		London.		Glasgow.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
TTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12lb.
ritish ...	15 0	14 0	—	—	16 6	14 6	15 0	—
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
ish Creamery	112 0	106 6	108 6	105 0	106 6	102 6	113 0	—
,, Factory	98 6	93 0	98 0	88 0	98 6	95 0	—	—
anish ...	—	—	118 0	115 0	117 6	115 6	116 6	—
rench ...	—	—	—	—	123 6	119 0	—	—
ussian ...	103 6	99 0	101 6	96 6	102 6	99 6	103 0	99 0
anadian ..	109 0	106 6	105 0	101 6	—	—	—	—
ustralian ...	109 0	101 0	105 6	102 6	105 6	102 0	107 6	103 0
ew Zealand	111 0	108 0	109 0	107 0	108 6	106 0	110 0	—
rgentine ...	—	—	105 0	103 6	106 0	103 6	105 6	—
IEESE :—								
ritish—								
Cheddar ...	74 0	59 0	74 0	70 0	75 6	67 0	61 0	55 0
			120 lb.	120 lb.	120 lb.	120 lb.		
Cheshire ...	—	—	74 6	67 0	79 6	71 0	—	—
			per cwt.	per cwt.	per cwt.	per cwt.		
anadian ...	58 0	56 0	58 6	56 0	59 0	58 0	58 6	56 0
CON :—								
ish	70 0	65 0	64 6	61 0	68 6	65 0	69 0	66 0
anadian ...	61 0	59 0	59 0	56 6	60 0	58 6	62 0	59 6
MS :—								
umberland ...	—	—	—	—	122 6	111 0	—	—
ish	—	—	—	—	119 0	111 0	90 0	79 0
merican (long cut) ...	72 0	63 0	69 0	60 0	68 6	63 0	65 0	61 6
GS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
ritish ...	20 0	18 4	—	—	20 0	18 4	—	—
ish	16 8	15 8	16 11	15 7	17 10	15 8	16 7	15 5
anish ...	16 6	15 6	16 5	15 6	17 5	14 5	16 11	15 0
TATOES :—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
dward VII...	85 0	75 0	—	—	80 0	71 0	—	—
angworthy ...	81 0	72 0	85 0	75 0	94 0	88 0	67 0	61 0
p-to-Date ...	86 6	75 0	63 6	60 0	81 6	71 6	57 0	54 0
Y :—								
lover ...	90 0	75 0	94 6	70 0	100 0	83 6	75 0	70 0
eadow ...	77 6	60 0	—	—	89 0	66 6	—	—

DISEASES OF ANIMALS ACTS, 1894 to 1910.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(*From the Returns of the Board of Agriculture and Fisheries.*)

DISEASE.	DECEMBER.*		TWELVE MONTHS ENDED DECEMBER.	
	1910.	1909.	1910.	1909.
Swine-Fever:—				
Outbreaks	203	104	1,598	1,650
Swine Slaughtered as diseased or exposed to infection ...	2,503	725	15,543	14,316
Anthrax:—				
Outbreaks	155	118	1,496	1,317
Animals attacked	185	146	1,776	1,698
Foot-and-Mouth Disease:—				
Outbreaks	—	—	2	—
Animals attacked	—	—	15	—
Glanders (including Farcy):—				
Outbreaks	18	24	355	533
Animals attacked	45	51	1,022	1,753
Sheep-Scab:—				
Outbreaks	142	124	554	685

IRELAND.

(*From the Returns of the Department of Agriculture and Technical Instruction for Ireland.*)

DISEASE.	DECEMBER.*		TWELVE MONTHS ENDED DECEMBER.	
	1910.	1909.	1910.	1909.
Swine-Fever:—				
Outbreaks	16	1	104	88
Swine Slaughtered as diseased or exposed to infection ...	163	8	2,236	1,570
Anthrax:—				
Outbreaks	—	—	7	8
Animals attacked	1	—	13	8
Glanders (including Farcy):—				
Outbreaks	—	—	1	—
Animals attacked	—	—	2	—
Sheep-Scab:—				
Outbreaks	73	51	492	424

* Including five weeks in 1910 and four weeks in 1909.

ADDITIONS TO THE LIBRARY.

[NOTE.—The receipt of *annual* publications of foreign agricultural and other departments, experiment stations and societies is not noted in the monthly list of additions to the Library. A list of these publications appeared in the *Journal* for October, November and December, 1909.]

Agriculture, General and Miscellaneous—

Rhode Island Agricultural Experiment Station.—Bull. No. 139:—Studies of the Needs of Rhode Island Soils. (33–104 pp.) Kingston, Rhode Island, 1910. [B. 40–7; B. 24–1.]

U.S. Dept. of Agriculture, Bureau of Animal Industry.—Bull. No. 39:—Index-Catalogue of Medical and Veterinary Zoology. Part 32. [Authors: V to Vyner.] (2443–2508 pp.) Washington, 1910. [B. 7; H. 28–1.]

Contributions from the United States National Herbarium.—Volume 13, Part 6:—The Type Localities of Plants First Described from New Mexico. (137–227 pp., plate and map.) [B. 16–1.] A Bibliography of New Mexican Botany. (229–246 pp.) [B. 7; B. 16–1.] Volume 15:—The North American Species of Panicum. (396 pp.) [B. 16–1.] Washington, 1910.

Ladik, Dr. Gustave de.—Aperçu de la Législation concernant l'Administration de l'Agriculture hongroise. [Edition du Ministère Roy. Hong. de l'Agriculture.] (253 pp.) Budapest, 1910. [A. 34.]

Memoirs of the Geological Survey, England and Wales.—The Geology of the Country around Nottingham. (72 pp. and chart.) London: E. Stanford, 1910. 2*s.* [B. 36.]

Osborne, T. B.—The Vegetable Proteins. (125 pp.) London: Longmans, Green and Co., 1909. 3*s.* 6*d.* net. [B. 22–1.]

U.S. Dept. of Agriculture, Bureau of Plant Industry.—Bull. No. 187:—A Study of Cultivation Methods and Crop Rotations for the Great Plains Area. (78 pp.) [A. 80.] Bull. No. 189:—The Source Dioscorea, with a Consideration of the Dioscoreæ found in the United States. (29 pp.) [B. 16–1.] Bull. No. 190:—Orchard Green-Manure Crops in California. (40 pp.) [B. 28–5; D. 28–3.] Washington, 1910.

U.S. Dept. of Agriculture.—Farmers' Bull. No. 408:—School Exercises in Plant Production. (48 pp.) [B. 16–5.] No. 422:—Demonstration Work on Southern Farms. (19 pp.) [B. 44–17; B. 46.] Washington, 1910.

U.S. Dept. of Agriculture, Office of Experiment Stations.—Bull. No. 232:—Consolidated Rural Schools and Organization of a County System. (99 pp.) [B. 44–17.] Circ. No. 99:—Farmers' Institutes for Young People. (40 pp.) [B. 44–17.] Washington, 1910.

U.S. Dept. of Agriculture, Bureau of Soils.—Bull. No. 70:—Some Effects of a Harmful Organic Soil Constituent. (98 pp.) Washington, 1910. [B. 40–1.]

Board of Education.—Syllabuses of Courses in Rural Science and Rural Technology, and of Agricultural Science and Rural Economy. (36 pp.) London: Wyman and Sons, 1910. 1*d.* [B. 44–5.]

Ewart, A. J.—Plants Indigenous to Victoria. Vol. II. (37 pp. and plates.) Melbourne: Government Printer, 1910. [B. 16–1.]

Tuskegee Normal and Industrial Institute, Experiment Station.—Bull. No. 16:—Some Ornamental Plants of Macon County, Alabama. (24 pp.) 1909. [B. 16–1.] Bull. No. 18:—Nature Study and Gardening for Rural Schools. (23 pp.) 1910. [B. 44–1.] Tuskegee, Alabama.

University of Nebraska Agricultural Experiment Station.—Bull. No. 114:—Storing Moisture in the Soil. (52 pp.) [B. 40–1; M. 10.] Bull. No. 115:—The Determination of Humus. (25 pp.) [B. 40–5.] Lincoln, Nebraska, 1910.

Ewart, A.J., and others.—Contributions to the Flora of Australia, Nos. 14 and 15. [Reprinted from Proc. Roy. Soc. Victoria. Vol. XXIII. (New Series.) Pt. I.] (54–64 and 110–115 pp. and plates.) Melbourne: Royal Society of Victoria, 1910. [B. 16–1.]

Field Crops—

Agricultural Research Institute, Pusa.—Bull. No. 20:—Memorandum on Indian Wheat for the British Market. (40 pp.) Calcutta: Superintendent, Government Printing, 1910. 6*d.* [C. 2–3.]

U.S. Dept. of Agriculture.—Farmers' Bull. No. 409:—School Lessons on Corn. (29 pp.) [C. 20.] No. 415:—Seed Corn. (12 pp.) [C. 20.] No. 417:—Rice Culture. (30 pp.) [C. 58–1.] No. 420:—Oats: Distribution and Uses. (24 pp.) [C. 16.] Washington, 1910.

U.S. Dept. of Agriculture, Bureau of Plant Industry.—Circ. No. 68:—Handling Wheat from Field to Mill. (12 pp.) Washington, 1910. [C. 2.]

Tuskegee Normal and Industrial Institute, Experiment Station.—Bull. No. 15:—Increasing the Yield of Corn. (11 pp.) 1909. [C. 20.] Bull. No. 17:—Possibilities of the Sweet Potato in Macon County, Alabama. (20 pp.) 1910. [C. 26–3.] Tuskegee, Alabama.

University of Nebraska Agricultural Experiment Station.—Bull. No. 113:—Oats: Variety Tests, Rate of Sowing, Cultivation. (16 pp.) Lincoln, Nebraska, 1910. [C. 16.]

Lancaster County Council.—Farmers' Bull. No. 17:—Report of Field Trials on the Liming of Meadow Land, 1906–9. (18 pp.) Preston, 1910. [C. 42–9.]

Horticulture—

Michigan Agricultural College Experiment Station.—Bull. No. 262:—Suggestions on Planting Orchards. (29 pp.) East Lansing, Michigan, 1910. [D. 16–3.]

Plant Diseases—

University of California Agricultural Experiment Station.—Bull. No. 207:—The Control of the Argentine Ant. (51–82 pp.) Berkeley, California, 1910. [E. 40–51.]

U.S. Dept. of Agriculture, Bureau of Entomology.—Circ No. 126:—Insect Injuries to the Wood of Living Trees. (4 pp.) [E. 40–13.] Bull. No. 64, Part X.:—Some Miscellaneous Results of the Work of the Bureau of Entomology—The Pecan Cigar Case-Bearer, *Coleophora caryæfoliella*, Clem. (75–86 pp. and plates.) [E. 40–51.] Bull. No. 85, Part VIII.:—Papers on Cereal and Forage Insects.—The Cowpea Curculio, *Chalcodermus æneus*, Boh. (125–142 pp.) [E. 40–51.] Bull No. 89:—The Grape Root-Worm, *Fidia viticida*, Walsh, with especial reference to investigations in the Erie Grape Belt from 1907 to 1909. (100 pp. and plates.) [E. 40–51.] Washington, 1910.

Harper Adams Agricultural College.—Wart Disease of Potatoes, *Synchitrium endobioticum*, Percival. (40 pp.) Newport, Salop, 1910. [E. 60–35.]

Live Stock—

Rhode Island Agricultural Experiment Station.—Bull. No. 140:—Abstracts of Feeding Experiments. [F. 62–3.] Analyses of Feeding Stuffs. (105–133 pp.) [F. 74–1.] Kingston, Rhode Island, 1910.

Gilbey, Sir W.—Farm Stock 100 Years Ago. (154 pp.) London: Vinton and Co., 1910. 5*s.* net. [F. 2.]

Pennsylvania State College Agricultural Experiment Station.—Bull. No. 102:—Methods of Fattening Steers. (16 pp.) Centre County, Pennsylvania, 1910. [F. 68–1.]

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SPRAYING EXPERIMENTS WITH A LIME-SULPHUR SUMMER WASH.

E. S. Salmon, F.L.S.,
Mycologist to the South-Eastern Agricultural College, Wye, Kent.

In this *Journal* for June last (p. 184) an account was given of a method of making a lime-sulphur wash for use on foliage, and of some results obtained on using this wash against the hop "mildew" or "mould." During the past summer further spraying experiments with this wash were carried out on the foliage of apples and gooseberries in the plantations at the South-Eastern Agricultural College, Wye, and on two farms in Kent.

Before giving the details of these experiments, a few remarks may be made on the subject of lime-sulphur summer-washes and their properties. In England, as in other fruit-growing countries, a good fungicide is required for use on those varieties of apples which are injured when sprayed with Bordeaux mixture. It is now generally recognised by apple-growers in this country that—with respect to the greater number of the varieties cultivated commercially—it is impossible to grow a perfectly clean crop of apples (free from all trace of "black spot" or "scab") unless the foliage* of the trees is kept clean by spraying it with Bordeaux mixture. On some varieties of apple, however, *e.g.* on "Cox's Orange Pippin" and "Duchess' Favourite," the use of Bordeaux mixture is liable to be attended by such marked injury to the leaves (resulting in a more or less complete defoliation of the tree) or to the fruit (which becomes

* See the article on Apple "Scab" or "Black Spot," in this *Journal* for June, 1908.

"russeted" or "rusty"), that an efficacious spray harmless to apple foliage and fruit is badly needed.* In America the same problem confronts the apple-grower. The foliage of some of the varieties of apples cultivated in that country, *e.g.* the "Newtown Pippin," is so susceptible to injury from Bordeaux mixture that 80 per cent. of the leaves may fall; while the fruit of other varieties, *e.g.* "Ben Davis," suffers so greatly from injury when Bordeaux mixture is used that this spray has had to be abandoned.

A further need in this country for a new fungicide—which may possibly be supplied by a lime-sulphur wash—exists in connection with the control of the American gooseberry-mildew. When the "summer stage" of this mildew begins to appear in May or June, the disease will, under favourable weather conditions, spread through the plantation at a rapid rate (just as the closely-related hop "mould" does through the hop garden) unless spraying is carried out. It has been well established by scientific experiments that a wash made of "liver of sulphur" (polysulphides of potassium) is thoroughly efficacious in killing the mildew in its summer stage and so preventing its spread, but in order to achieve this result the wash has to be applied every ten days (and oftener if it rains) throughout the growing period of the gooseberry bush. As the weather is very frequently showery at the time when the mildew is appearing, the repeated sprayings with the "liver of sulphur" wash (which is removed by rain) necessary to prevent the disease spreading, may make the operation too expensive for the commercial gooseberry-grower. A sulphur-wash which is not readily washed off by rain is required.

Lime-sulphur washes for summer use as fungicides may be divided into two classes: (1) the "self-boiled" lime-sulphur wash; (2) the "factory-boiled," or "home-boiled," lime-sulphur wash.

A "self-boiled" lime-sulphur wash which has been used with some success in the United States is made as follows: place 8 lb. of quicklime in a 50-gallon barrel, and pour two or three gallons of boiling water over it. Stir 8 lb. of

* See the article "Injury to Foliage by Bordeaux Mixture," in this *Journal* for May, 1910.

"flowers of sulphur" (running the sulphur through a fine sieve in order to break up any lumps) into the slaking lime and add another bucket of hot water. Stir occasionally in order to prevent caking. Cover over the barrel with sacking in order to retain the heat given out by the lime slaking, which will cause the mixture to boil for 10 to 20 minutes, according to the quality of the lime. During this boiling a small amount of the sulphur goes into solution. As soon as the lime has slaked—that is, as soon as boiling has ceased—add cold water up to the 50-gallon mark, in order to prevent more sulphur going into solution. The mixture should be strained through a sieve of 20 meshes to the inch in order to remove the coarse particles of lime, but all the sulphur should be worked through the strainer. The mixture is then ready for use; in its application a specially good agitator is required in the tank or barrel of the spraying machine. In this mixture the finely-divided sulphur in mechanical mixture with the lime is depended upon for the fungicidal action rather than the sulphur in solution. Spraying experiments lately carried out in the United States have shown that this "self-boiled" lime-sulphur wash acts as a fungicide, but that it is of moderate power only and is not a strong enough fungicide to be recommended for use against severe attacks of apple "scab." It is entirely harmless to the foliage and fruit of apples; indeed, so safe is it with respect to foliage that it can be used on the tender leaves of the peach.

In August last a Bulletin was published by the United States Department of Agriculture* in which the results are given of spraying experiments, carried out in 1909, with lime-sulphur washes and also with certain new modifications of them in which either iron sulphate or copper sulphate is added. One of the most promising mixtures is termed the iron-sulphide mixture; it is prepared as follows: a 50-gallon barrel of the "self-boiled" lime-sulphur mixture is prepared exactly as mentioned above, except that the cold water, when added, must rise not to the 50-gallon mark, but to a 40-gallon mark. Then add 10 gallons of water in which

* U.S. Department of Agriculture, Bureau of Plant Industry, Circular No. 58 (August 1, 1910).

3 lb. of iron sulphate have been dissolved. The mixture, which on being stirred turns inky black, is (according to the Bulletin) "apparently colloidal or somewhat gelatinous in texture, and after drying on the trees turns a dark slate colour. In a few days this oxidises to a reddish-brown colour, which remains constant." This mixture has, apparently, considerable fungicidal properties; it proved not only quite harmless to apple foliage, but even to have some beneficial effect; the leaves of the sprayed trees became darker green and hung longer on the trees; "the twigs were also more stocky and the fruit-buds plumper."

A very similar mixture is the copper-sulphide mixture. This is made as above except that 2 lb. of copper sulphate dissolved in 10 gallons of water are added to the self-boiled lime-sulphur mixture. This mixture, although a copper-containing one like Bordeaux mixture, was found to cause only very slight injury to the fruit or foliage of apples. When used on trees of the "Ben Davis" variety—which, as mentioned above, is specially susceptible—there resulted only one-sixth of the injury which was caused to the fruit when Bordeaux mixture was used. The injury to the apple foliage was so slight as to be scarcely noticeable. The Bulletin says: "We have in the copper sulphide the least injurious form of copper, and if copper is absolutely necessary for ultimate success in controlling the most difficult diseases, this form of spray produces the minimum amount of injury."

In leaving the subject of the "self-boiled" lime-sulphur wash, and its modifications, a word of warning must be given to the commercial grower. All these washes are still in the experimental stage only, and are not suitable for general use on a large scale. The Bulletin above mentioned says on this point: "The harmless character of the iron-sulphide is believed to be pretty well shown. It will require tests under severe outbreaks of fungous diseases before its fungicidal powers can be properly determined however. The iron-sulphide, or even the copper-sulphide, will not be recommended for commercial work until further tested. They should be tried, if at all, in experiments in a small way." It is pointed out, further, that it has been shown that the factory- or home-boiled lime-sulphur wash (which is dealt

with below) is a more powerful fungicide than the "self-boiled" lime-sulphur mixture and is perfectly safe when diluted to a certain strength, and the Bulletin concludes: "This mixture is therefore recommended in spraying the apple, and is available for those cases where apple "scab" or some other serious disease is feared and a stronger fungicide than self-boiled lime-sulphur is desired."

To proceed now to a consideration of the second class: the "factory-boiled" or "home-boiled" lime-sulphur wash. This is made by boiling the lime and sulphur together for an hour or so, with the result that nearly all the sulphur goes into solution. In the United States this wash in a concentrated form is placed on the market * at various guaranteed strengths by firms of repute; this is known as the "factory-boiled" lime-sulphur wash. The same wash can be prepared, also in a concentrated form, by the grower himself; this is spoken of as "home-boiled." The formula which is believed to be the best is 50 lb. of quicklime, 100 lb. of "flowers of sulphur," boiled together for an hour in 50 gallons of water. Before being used, the concentrate has to be greatly diluted. For the exact method of preparation and dilution, and information as to its chemical nature, the reader is referred to the article in this *Journal* for June last.

The right strength at which to use this "home-boiled" wash on foliage is at present, even in the United States, still largely a matter for experiment. It has been used on apple foliage in several spraying experiments in the States at a density of 1·01 to 1·015 sp. gr., and it is claimed that this wash possesses stronger fungicidal properties than the "self-boiled" wash, and is about as effective as Bordeaux mixture in checking the "scab," while it is very much less injurious to the foliage than Bordeaux mixture and harmless to the fruit.

It was obvious that before this wash could be used commercially in this country with any safety, it was necessary to ascertain to what extent the concentrate requires to be diluted so as to make the wash harmless for the foliage of those tender varieties, such as Cox's Orange Pippin, which becomes injured when Bordeaux mixture is used. In the United States

* Now obtainable in this country.

the advice is given to use a wash of the specific gravity 1·01 to 1·015 on apple and pear foliage—"the lower density to be used if the grower is compelled to spray in unusually wet and cold weather, or if much leaf-injury appears"; 1·01 for the foliage of the cherry; while for peach and plum foliage the sp. gr. should be 1·003 to 1·008.* No information, apparently, has been given as to the strength suitable for the gooseberry. During the past season the following spraying experiments were carried out with the object of obtaining information on this point. A concentrated "home-boiled" lime-sulphur wash † (prepared exactly as described in this *Journal* for June last) was diluted with water to a specific gravity of 1·01—this may be called the "full-strength" wash; when injury to sprayed foliage appeared the wash was further diluted to 1·005—which may be called the "half-strength" wash; further dilution was made when necessary.

Spraying Experiments on Apples.

(1) During May several trees (having flower-buds on the point of opening) of the following varieties growing in the College plantations were thoroughly sprayed ‡ with the wash at "full-strength" (sp. gr. 1·01): Cox's Orange Pippin, Bismarck, Worcester Pearmain, Duchess' Favourite, Belle de Pontoise, and Golden Spire. No injury resulted to the foliage of any variety.

(2) On June 2nd single trees of the following varieties (growing in a plantation at Selling, Kent) were thoroughly sprayed in hot, sunny, close weather with the "full-strength" wash: Beauty of Bath, Worcester Pearmain, Cox's Orange Pippin, Allington Pippin, Charles Ross, Peasgood's Nonsuch, and King of the Pippins. Somewhat severe "scorching" of the foliage resulted on Cox's Orange Pippin—about a third of the leaves being more or less affected; Charles Ross was similarly injured, but not to so great an extent;

* *Pennsylvania State Coll. Agric. Exper. Station, Bulletin* 92.

† A leaflet (price 1*d.*) giving full instructions for the preparation of the wash can be obtained on application to the Secretary, Wye College, Kent.

‡ In all the experiments the spray was applied with a "Bordeaux nozzle" (see this *Journal* for January, 1910) throwing a very fine, "misty" spray, by means of which the surface of the leaves was thoroughly covered; when dry, the leaves appeared covered over uniformly with a whitish, dust-like powder.

Allington Pippin and King of the Pippins suffered slightly; Beauty of Bath, Worcester Pearmain, and Peasgood's Nonsuch showed no appreciable injury.

(3) On June 4th, in sunny weather, eight trees of Duchess' Favourite in the College plantation were thoroughly sprayed with the "full-strength" wash. At the same time eight trees of Duchess' Favourite and 24 trees of Warner's King (in both cases interplanted in the same row as the above) were thoroughly sprayed with home-made Bordeaux mixture (4 lb. copper sulphate, 4 lb. quicklime (in lumps), 50 gallons water*); nine trees of Duchess' Favourite (interplanted in the same row) were left unsprayed as controls. The lime-sulphur wash caused only very slight "scorching" on the foliage of the Duchess' Favourite, and no defoliation occurred; the Bordeaux mixture on the same variety produced no signs of injury at first, but after four weeks, *i.e.* at the beginning of July, the leaves began to fall; this continued until, by the end of July, these trees were almost completely defoliated. No leaf-injury or leaf-fall occurred on the "control" trees of Duchess' Favourite. There was clear proof that Bordeaux mixture was unsafe to use at that time of year in a wet season, while under the same weather conditions the lime-sulphur wash, at "full strength," caused no appreciable injury. Another interesting feature was the behaviour of the trees of Warner's King sprayed with Bordeaux mixture. Here, although the spray had been very thoroughly applied to practically every leaf (so that the trees, when the spray had dried, looked quite blueish), and notwithstanding the fact that the "scab" fungus was already present on many of the leaves at the time of spraying, no injury whatever resulted to the foliage or to the fruit. We see, then, that under weather conditions which will cause Bordeaux mixture to bring about the defoliation of one variety of apple (Duchess' Favourite), the foliage of another variety (Warner's King) will remain unaffected.

(4) On June 8th 25 trees of Worcester Pearmain and 25 trees of King of the Pippins (growing in a plantation at Selling) were thoroughly sprayed in hot, sunny weather with the lime-sulphur wash at "full strength." After about ten

* See this *Journal* for January, 1910.

days the foliage of the King of the Pippins was noticeably scorched, and some defoliation occurred; similar, but slighter, injury occurred on the Worcester Pearmains.

(5) On June 15th four large standard trees of Blenheim Orange and one large tree of Besspool (Tower of Glamis), in an orchard near Marden, Kent, were thoroughly sprayed in sunny weather with the "full-strength" wash—25 gallons being sprayed on to the trees. A considerable amount of "scorching" was caused, and defoliation occurred to a slight extent.

(6) On June 21st 26 trees (Cox's Orange Pippin, six trees Worcester Pearmain, 12 trees; Bismarck, eight trees) growing in the College plantation, were thoroughly sprayed with the lime-sulphur wash at two strengths—"full-strength" (sp. gr. 1·01) and "half-strength" (sp. gr. 1·005). At the same time 12 trees of Worcester Pearmain were thoroughly sprayed with Bordeaux mixture (made on the formula 4:4:50). "Control" trees of each variety were left unsprayed. The sprayed trees were closely examined afterwards each day for ten days. No injury was apparent on the sprayed foliage of any variety until the third day, when the leaves on the Cox's Orange Pippin trees which had been sprayed with the "full-strength" wash showed some "scorching." On the fourth day the "scorching" had increased on these trees; and by the fifth day these trees showed severe "scorching" on a large percentage of the leaves, some of which had begun to curl. By this time (the fifth day after spraying) the trees of Cox's Orange Pippin which had been sprayed with the "half-strength" wash showed slight "scorching" on a few leaves, but not to any serious extent. By the seventh day the trees of Cox's Orange Pippin which had been sprayed with the "full-strength" wash had begun to drop the "scorched" leaves; by the eighth day the defoliation was more marked. On the Cox's sprayed with the "half-strength" wash no further injury was visible, and no leaves had fallen by this date. On the tenth day the appearance of the Cox's which had been sprayed with the "full-strength" wash showed clearly that considerable injury had been done to the trees—defoliation had occurred to a serious extent, quite half the leaves having fallen off. The trees of

Cox's which had been sprayed with the "half-strength" wash showed on the tenth day a slight "scorching" on a few leaves, and a very few leaves had fallen off; as far as could be seen, no serious injury had been done to the trees. No injury resulted on the trees of Worcester Pearmain and Bismarck sprayed with the lime-sulphur washes, nor on the Worcesters sprayed with Bordeaux mixture.

(8) On June 22nd, in dull weather (no sunshine), 17 trees of Cox's Orange Pippin, and one tree of Cox's Pomona—all growing in the College plantation—were sprayed with a lime-sulphur wash at two strengths ("full-strength" and "half-strength"). At the same time eight trees of Cox's Orange Pippin and one tree of Cox's Pomona were sprayed with Bordeaux mixture (made on the formula 4:4:50). A number of trees were left unsprayed as "controls." Of the trees sprayed with the "full-strength" lime-sulphur wash, (1) the eight bush trees of Cox's Orange Pippin showed severe scorching of the leaves, which soon resulted in severe defoliation; (2) the one espalier tree of Cox's Orange Pippin showed slight "scorching," but no leaf-fall occurred; (3) the one espalier tree of Cox's Pomona showed only a very slight trace of "scorching" and no leaf-fall occurred. The eight bush trees of Cox's Orange Pippin sprayed with "half-strength" lime-sulphur wash showed only very slight scorching of the leaves—doing no appreciable injury—and no defoliation occurred. Of the trees sprayed with Bordeaux mixture, both the bush and espalier trees of Cox's Orange Pippin (eight bush trees and one espalier), and the one espalier of Cox's Pomona showed only a slight spotting of the leaves, and no leaf-fall resulted.

Spraying Experiments on Gooseberries.

(1) During May a considerable number of bushes of Whinham's Industry and Berry's Early, growing in the College plantation, were thoroughly sprayed with the lime-sulphur wash at full strength (sp. gr. 1·01). No injury to the leaves resulted.

(2) On June 4th, when some apple trees in the College plantation were sprayed (in sunny weather) with the "full-strength" lime-sulphur wash, a number of inter-planted

gooseberry bushes of the "Yellow Rough" variety received a fairly heavy application of the wash. After a few days the injurious effect of the wash was very marked—the bushes being nearly defoliated, all the leaves having dropped off from the young shoots.

(3) On June 21st several bushes of Whinham's Industry, growing in the College plantation, were sprayed with the "full-strength" or with the "half-strength" lime-sulphur wash. Some "scorching" occurred in both cases, and a considerable number of leaves fell off.

(4) On June 21st a plot of 39 gooseberry bushes of the varieties Berry's Early, Whinham's Industry, and Lancashire Lad (growing in the College plantation) were thoroughly sprayed with the lime-sulphur wash of two strengths—sp. gr. 1·005 and sp. gr. 1·003. The plot was divided into two parts; one part contained 13 bushes, which were sprayed with the wash of sp. gr. 1·005; the other part contained 26 bushes, which were sprayed with the wash of sp. gr. 1·003. Both parts of the plot contained bushes of the three varieties. The bushes of Lancashire Lad sprayed with the 1·005 wash, as well as those sprayed with the 1·003 wash, were seriously injured, and after a few days lost practically all their leaves; in neither part of the plot was any injury done to the Berry's Early or to the Whinham's Industry. At the time of spraying the American Gooseberry-mildew (in the summer stage) was infesting the bushes and spreading rapidly; the lime-sulphur wash appeared efficacious in stopping the spread of the mildew.

Mr. H. J. Small, of Evesham, Worcestershire, following instructions sent to him from Wye College, has experimented with the lime-sulphur wash prepared in concentrated form and diluted (using the hydrometer) to a specific gravity of 1·01. Trees of Cox's Orange Pippin which were badly affected with Apple-mildew (*Podosphaera leucotricha*) were sprayed during May. Mr. Small reports that no "scorching" of the foliage occurred, and that the wash seemed to have a beneficial effect in checking the spread of the mildew by preserving the healthy foliage from becoming infected.* In this instance—where no "scorching" occurred—rain fell

* Hop leaves are similarly protected by the same wash from attacks of the hop mildew or "mould" (see this *Journal* for June, 1910, p. 184).

during the night after the day on which the spraying had been done, though it did not visibly remove any of the wash. On other occasions—later in the season and under different weather conditions—spraying with the wash at the same strength "scorched" the foliage of Cox's Orange Pippin very severely.

Conclusions.—In the above experiments no opportunity occurred for testing the value of lime-sulphur as a fungicide against apple "scab" or "black spot." As, however, it has been stated, as the result of experiments carried out in the United States, that it "is about as effective" for this purpose as Bordeaux mixture, the lime-sulphur wash may be recommended for trial in this country on those varieties of apples whose foliage or fruit will not stand spraying with Bordeaux mixture. The above experiments show that while the foliage of some varieties, *e.g.* Worcester Pearmain, show no injury when sprayed with a lime-sulphur wash of sp. gr. 1·01, the foliage of other varieties, *e.g.* Cox's Orange Pippin, Charles Ross, King of the Pippins, Blenheim Orange, and Besspool (Tower of Glamis) are severely "scorched" by the wash at this strength. For such varieties a lime-sulphur wash of sp. gr. 1·005 should be used when spraying them in June or later—though possibly the "full-strength" wash is safe to use in May. It must not be forgotten, however, that in fighting apple "scab" or "black spot" Bordeaux mixture still remains the best fungicide known, and should always be used for this purpose *except on those varieties of apples which are liable to "Bordeaux injury."* The lime-sulphur wash, as well as the iron sulphide and copper-sulphide washes mentioned above, should only be used at present experimentally and on a small scale.

The experiments noted above give some evidence that the "home-boiled" lime-sulphur wash is efficacious against "powdery mildews." Although the wash has been used at "full strength" (sp. gr. 1·01) in May on the foliage of apples and gooseberries without causing any injury, it is advisable at present to use the wash at "half-strength" (sp. gr. 1·005); later in the season a weaker wash is necessary when used on certain varieties of gooseberries—a point which requires further investigation.

EXPERIMENTS IN POTATO GROWING.

HENRY HENSHAW,

Farm Superintendent, Department of Agriculture, Cambridge University.

POTATOES are an important crop in most of the counties associated with the Department of Agriculture of the University of Cambridge; in certain of the districts, indeed, the chief farm crop. Part of the University farm at Impington has therefore been devoted to potato growing for the purpose of furnishing reliable information on the merits of new varieties and other important features of their cultivation.

As the vigour and cropping powers of a potato appear to decrease after comparatively few years' growth, and its susceptibility to disease to increase, it is necessary to provide growers with new and more vigorous sorts. The most important point in successful potato cultivation is to secure the best variety for the district, and the results of the experiments to be described were mainly undertaken for the purpose of testing varieties. Variety testing in the case of the potato crop is required, not only because of the many new varieties which are constantly appearing, but also because the best sort is more a question of locality than is the case with other farm crops. Tests made in other parts of England do not serve the purpose of farmers in East Anglia. Some varieties certainly do well in any district, but there are many kinds which are only profitable under certain conditions. The summary in the following pages states the main results of experiments carried out at Impington and in the neighbouring counties from the year 1902 up to and including the year 1910.

Methods adopted in these Experiments.—It is desirable in the first place to explain how these experiments were conducted. The potato is a very satisfactory crop to experiment with if proper precautions are taken, but there are few crops from which such misleading figures may be obtained if these precautions are omitted. The results referred to here were obtained on small plots varying from $\frac{1}{4}$th to $\frac{1}{160}$th of an acre in size. In most cases, however, they were $\frac{1}{40}$th of an acre, generally 58 ft. in length and 18 ft. in width. The plots were always laid out in duplicate as a guard against

errors due to variation in the soil, and no outside row was included in the area to be weighed.

The results of these duplicate plots in the great majority of cases did not vary by more than one ton per acre. The regularity of the yield is shown by the following figures.

Variations of less than 10 cwt. per acre	159
,, between 11 cwt. and 20 cwt., per acre	87
,, ,, 21 ,, 30 ,, ,, ...	39
,, ,, 31 ,, 40 ,, ,, ...	19
,, ,, 41 ,, 50 ,, ,, ...	11
,, above 50 cwt. ... ... ,, ...	4
Total number of pairs of plots	319

The same number of sets was planted on each plot, usually 49 per row, at uniform distances of 14 in. apart. Approximately the same weight of sets was planted on each plot. It would have been desirable to have planted the same weight on each, but so long as the sets are of moderate size, number is much more important than weight. In many of the experiments, however, the weight per lot was equal, being 42 lb. on a $\frac{1}{40}$th-acre plot; or 15 cwt. per acre. It was found impossible to secure equality of both number and weight when dealing with purchased tubers, so number was selected in preference to weight, as in the earlier years of these trials it had been found that a difference of 2–3 cwt. per acre in seed rate made no material difference to the total weight of crop. This question of size of sets will be more fully discussed later.

It was the usual custom to plant whole sets, but occasionally when using purchased tubers, or when only small quantities of home-grown ones were available, it was necessary to cut the sets. The effect of this treatment will also be discussed later.

Of all the points in connection with the potato crop, that which requires the most careful attention of the grower is the source from which his seed is obtained. This fact has been impressed upon us more emphatically each year, and some of the earlier conclusions are invalid because a full knowledge was lacking of the conditions under which the potatoes supplied to us were grown.

The storing of seed for experimental work needs careful attention to see that each series of plots has identically the same treatment prior to planting, and the better way appears

to be to put the seed into sprouting trays. It was the practice to place early varieties in the "boxes" at the end of the year and the main crops or later kinds about the end of February.

Change of Seed.—The source of his seed potatoes is the most important point which the potato grower has to consider. The benefits due to change are well known, but the reasons for these benefits are not so clearly appreciated, and very contradictory opinions are given as to the merits of certain districts for seed production. Before discussing this question, it will be well to examine the evidence which our experiments afford on the subject of change. Our earlier experiments with Scotch seed compared seed grown locally for one year with seed fresh from Scotland, and in 1903, in conformity with local opinion, we found that seed grown one year in Cambridge was quite as good as, indeed, rather better than, Scotch seed.

In 1904 a comparison was made between seed originally purchased in Scotland, which had been grown two years and one year respectively in Cambridge; and again, in accordance with the usual experience, we found that the latter gave the best crop. The results were :—

	Tons.	Cwt.
Factor potatoes one year from Scotland	13	4
,, ,, two years ,, ...	10	18
Difference due to newer seed	2	6

In the season 1905 further experiments on "change of seed" were made, and the following figures were obtained for four varieties :—

Variety.	History of seed.	Total crop. Tons.	Cwt.	Increase due to change. Tons.	Cwt.
Up-to-Date.	Five years in Cambridge	4	17		
,,	Fresh from Cromarty	14	13	9	16
British Queen.	Three years in Cambridge	5	3		
,, ,,	Fresh from the Lothians	15	13	10	10
Northern Star.	Three years in East Anglia ...	4	15		
,, ,,	Fresh from the Lothians	17	13	12	18
Factor.	Three years in Cambridge	10	10		
,,	Fresh from the Lothians	15	8	4	18
Factor.	Grown in Cromarty, 1904, from Cambridge seed	11	12		
,,	Grown in Norfolk, 1904, from Cambridge seed	9	6	2	6

Here we have the benefits of change shown in the clearest

possible way. Where fresh stock of Up-to-Date, British Queen, and Northern Star were compared with worn-out strains, we obtained respectively $9\frac{3}{4}$, $10\frac{1}{2}$, $12\frac{3}{4}$ tons increase, and where a stock of Factor, which had been on the farm in seasons 1903 and 1904, was compared with produce of sets purchased in the Lothians in the spring of 1905, the fresh seed produced an increase of five tons. But the most instructive figures in the above table are those contained in the last lines. In the spring of 1904 potatoes which had been grown in Cambridge in 1902 and 1903 were sent to be planted on a light loam soil at Field Dalling, near the north coast of Norfolk, in a district in which many potatoes are not grown, and at the same time another lot was sent to Cromarty, on the north-east coast of Scotland, to be grown on a loamy red sandstone soil specially adapted for the production of vigorous potato crops. From both districts sets were sent back to Cambridge in the spring of 1905, and planted side by side with the original stock. It was found that in neither case did the potato plant benefit markedly from the change. The contrast between the crop grown from Lothian seed that had not previously been in the south, and the crop that had been but one year in the north of Scotland, was very striking throughout the growing season.

In 1906 experiments on change of seed occupied 56 plots, and a great deal of useful information was obtained. The chief experiment was on the effect of climate on Up-to-Date seed obtained from the north-east and south-west of Scotland, the north of Ireland, North Wales, and from Kent. In all these cases the seed had been grown for at least two years in the district from which it came.

The following results were obtained :—

Variety.		Total crop. Tons.	Cwt.
Up-to-Date.	Grown in Cambridge for at least five years ...	7	3
	,, ,, one year, previously in Cromarty	14	12
	Grown in Cromarty for six years	16	19
	,, Dumfries for two years	16	0
	,, Co. Tyrone for two years	15	18
	,, Carnarvon for four years...	9	13
	,, Kent for two years	8	4

Similar results to the foregoing were got from Northern

Star, but it was noticed that the Stars one year from Scotland were relatively less vigorous than the Up-to-Date.

	Tons.	Cwt.
Old stock grown in Cambridge three years	4	15
One year in Cambridge	11	16
Fresh from Midlothian	14	8

The proportion of chats was much higher in the produce of fresh seed than in the case of the crop one year from Scotland; in fact, this appears to be generally the case in all varieties.

These "change of seed" experiments were continued in 1907 and in 1908, and with very much the same results. Many more instances of increased yield might be quoted, but one further example will suffice.

	Tons.	Cwt.
Up-to-Date; third year from Cromarty yielded	7	1
Fresh from Cromarty	11	5

As also mentioned earlier, the second season's growth is often heavier than the first (*i.e.*, direct from Scotland), and the following figures taken from the 1907 results may be quoted to substantiate the statement.

Variety.		Total crop. Tons.	Cwt.
What's Wanted.	From the Lothians in 1905	6	16
,,	,, ,, 1906	8	12
,,	,, ,, 1907	7	16
Dalmeny Acme.	From the Lothians in 1905	10	14
,,	,, ,, 1906	11	14
,,	,, ,, 1907	11	9

Enough has been said to prove the importance of "change of seed" every second year, and the question arises, where is the seed to be obtained? It was found after trying sets from various parts of Scotland that any one district was not always to be relied on to give the heaviest yields. It is apparently a matter of season, or the conditions under which the potatoes are ripened and harvested. In some years the north has the advantage, and others, the south of Scotland.

Since 1905 many comparisons of the results of using seed from Ireland or from Scotland have been made on the University farm, and also in Hertfordshire and in the Huntingdonshire Fens.

The general result obtained has been that seed from Ireland is as good a change as seed from Scotland. In some years and in some districts the crop from the Irish seed was

heavier than that from the Scotch seed, and in other years the reverse. Two experiments, one in 1908 and the other in 1910, tend to prove that seed from the west, north-west, and south-west parts of Ireland is distinctly better and produces heavier crops than seed obtained from the east side of that country.

A potato grower then, in the east of England, may reasonably expect an increased yield of potatoes of from 2–3 tons per acre if he changes his seed every two years, and he will be equally safe in purchasing his stocks either from Ireland or Scotland, provided he uses his judgment in making inquiries beforehand.

Size of Sets.—The effect of the size of sets has been tested on the University Farm for four years, with the result that medium sets about $1\frac{1}{2}$ to $1\frac{3}{4}$ in. in diameter would seem to be the best. Such sets will weigh from 15 cwt. to 18 cwt. per acre, if planted 14 in. apart in 28-in. rows.

The following figures give the results of the first of these trials in 1905. The variety was Factor.

	Weight planted.	Total crop.		Ware.		Diseased.	
	Cwt.	Tons.	Cwt.	Tons.	Cwt.	Tons.	Cwt.
Sets between $1\frac{1}{4}$ and $1\frac{1}{2}$ ins. ...	$10\frac{3}{4}$	9	15	6	4	1	4
,, $1\frac{1}{2}$ and $1\frac{3}{4}$,, ...	$16\frac{1}{2}$	10	10	6	13	1	8
,, $1\frac{3}{4}$ and 2 ,, ...	$21\frac{1}{2}$	11	17	6	12	2	7
,, $2\frac{1}{4}$ ins. and over	56	13	14	6	8	2	12

Two interesting points may be noticed in this experiment. The large sets produced a relatively low percentage of ware, and they also seemed to produce a high percentage of diseased tubers. The prevalence of disease where larger sets are used is associated with the more luxuriant haulm.

In the later experiments of 1906 and 1907 the effect of large sets on the percentage of ware was again noticeable, the following figures showing the averages obtained from three sets of plots in each year. These represent a total of twenty-four plots.

	Weight planted.	Total crop.		Ware.	
	Cwt.	Tons.	Cwt.	Tons.	Cwt.
Sets between $1\frac{1}{4}$ and $1\frac{3}{4}$ ins.	18	11	0	8	8
,, $1\frac{3}{4}$ and $2\frac{1}{4}$,, ...	37	12	3	8	11

The most noticeable thing here is the extra weight of potatoes planted, amounting to practically 20 cwt. per acre, giving as increase only 3 cwt. per acre of ware or marketable

produce. It is obvious then that the smaller sets are much more profitable to use than the others.

Cutting of Sets.—This is an important question for the grower who must purchase seed potatoes in a distant market, for if he can safely cut the sets, a considerable saving will be effected.

Experiments on this question have been made for several years, with this result, that in some years, 1904 and 1905, it was found that cutting was distinctly favourable, and in others, 1903 and 1906, cutting the tuber seriously injured the crop, reducing it by 30 to 40 per cent.

In comparing the effect of cutting it should be mentioned that approximately the same weight of tubers was planted for each plant.

	Weight planted.	Total crop.		Ware.	
	Cwt.	Tons.	Cwt.	Tons.	Cwt.
Royal Kidney, $1\frac{1}{4}''$—$1\frac{1}{2}''$ planted whole ...	15	13	3	9	6
,, ,, $1\frac{3}{4}''$—$2''$ cut in two... ...	14	12	4	9	9
,, ,, $2''$—$2\frac{1}{2}''$ cut in three ...	15	11	14	9	0

The growth of haulm on the "whole set" plots was generally more vigorous than on either of the "cut plots," but the yield was not proportionate to the vigour of the haulm.

In the above figures it may be seen that though the total yield was reduced, the weight of marketable potatoes—or ware—was scarcely changed; this was pretty general in all these experiments. Another point which is worth noting was brought out, the Kidney-shaped varieties do not give such satisfactory results when cut as do the round- or pebble-shaped varieties.

Boxing of Sets.—The general results of the investigations into this part of the subject have clearly shown that for ordinary purposes there is no advantage to be gained in southern and eastern districts from the sprouting of the sets of late varieties. The season is sufficiently long to permit of the full development of the potato crop, and thus the sprouting tray is not required.

The experiments have shown that second earlies are slightly benefited, and about 10 cwt. per acre increase may safely be expected in consequence; and for earlies a larger increase still may be looked for.

Sprouting in Pits.—While discussing this question of sprouting, some experiments made on the effect of sprouting in the pit may be referred to.

It is generally believed that tubers which make long growths in the pit are much injured for planting. During the years 1905–6–7 the effects of this growth were demonstrated. About the middle of April, when planting was being proceeded with, the potatoes chosen for these trials were selected from the pits. They had sprouted very badly, and the sprouts were all rubbed off just previously to planting. At the same time, perfectly sound tubers with no sprouts were taken from the same pits, and planted beside the others under precisely similar conditions. To the surprise of everyone who visited and inspected these crops, no difference could be detected during the growing seasons.

The results being so contrary to expectation, the yields in the different years are set out below.

	Plot A.		Plot B.		Average.	
	Tons.	Cwt.	Tons.	Cwt.	Tons.	Cwt.
Factor (1905) sprouted in pits	10	5	10	13	10	9
,, (1905) sound	10	4	10	2	10	3
Northern Star (1906) sprouted in pits ...	13	13	11	14	12	13
,, ,, (1906) sound	13	14	10	17	12	6
Acme (1907) sprouted in pits	13	0	13	3	13	1
,, (1907) sound	13	0	12	12	12	16
Marvel (1907) sprouted in pits	13	10	12	17	13	3
,, (1907) sound	13	1	12	3	12	12

The above figures are very striking evidence that much injury does not result to ordinary main-crop potatoes required for seed by their growing in the pits. This conclusion, however, does not apply to those kept for consumption, as growth will very rapidly spoil the quality. It is perhaps possible that the reason the sprouted tubers gave such a good result is that the very fact of their sprouting early shows that they were more than ordinarily vigorous, whilst those with which they were compared may have failed to sprout through some inherent weakness.

Manuring of the Experimental Plots.—The manures used in the variety and other tests changed but little from year to year. The general practice was to apply farmyard manure at the rate of 12 tons per acre and a mixture of artificials supplying 30 lb. nitrogen, 75 lb. phosphoric acid, and 80 lb. of potash, costing approximately 45*s*. per acre. Great care

was taken to apply exactly the same amount of manure to each experimental plot, and the artificial manures were mixed and weighed up in bags before the planting season arrived, so that when the soil was ready all the experimental crops could be planted quickly, thus ensuring uniform conditions. The weight of artificial manures applied varied slightly in each year according to the quality of the fertilisers purchased, but the constituents of the mixture were always the same. The mixture applied in 1906 is shown below as being typical of the manuring in other seasons. Nitrogen was supplied in four forms, so as to extend its action, so far as possible, over the growing season. Bone meal was used chiefly with the object of producing a dry powdery manure that would keep in good condition when stored prior to sowing. The use of bone meal would cause a slight reversion in the soluble phosphate of superphosphate, but in practice this would not detract from the value of the manure.

The composition of the mixture is given below :—

35	lb.	of nitrate of soda	per acre.
100	,,	sulphate of ammonia	
75	,,	bone meal	
50	,,	dissolved bones	
340	,,	superphosphate	
155	,,	sulphate of potash	

Manurial Experiments.—For five consecutive years manurial tests were carried out in the County of Hertfordshire in districts where for many years very heavy dressings, 30 tons or so per acre, of "London dung" have been used. The object of these experiments was chiefly to see if smaller dressings of dung, supplemented by a compound artificial manure, would not give a more profitable crop. For four seasons out of the five the results have been that a very liberal dressing of manure has shown a direct financial loss. The extra manures have not increased the crops sufficiently to meet the cost of manuring.

When potato growing was begun in this neighbourhood the value of heavy dressings of "London dung" may have been obvious, and growers having discovered that the practice paid well, assume that it does so now. But as fertility accumulates in land, manures become less effective, and the assumption may be a costly one. The potato crop certainly pays for liberal treatment, but its capacity is not unlimited,

and growers cannot afford to purchase manure for which they get no return.

Tests of Varieties.

One of the most striking results accruing from these experiments is the large number of differently named potatoes which bear a very great similarity indeed to one another. Given similar treatment of seed for the two previous years, the raisers themselves of the so-called new varieties would not be able to "select" their own variety when growing with others of the same type.

The following groups have been drawn up on the results of our own experiments. Each variety was purchased as genuine stock under its own name, and grown side by side with its synonyms for several years. These groups could be considerably augmented were other names added which are known to resemble the respective types, but it is perhaps as well only to refer to those which have been actually observed under precisely identical conditions.

I.—*Varieties closely resembling Up-to-Date.*

Scottish Triumph.	Warrior.
Dalhousie Seedling.	Sir Mark Stewart.
Cottar.	King Loth.
Dalmeny Regent.	Table Talk.
,, Hero.	Heather Blossom.
,, Beauty.	Nobleman.
Factor.	Duchess of Buccleuch.
Duchess of Cornwall.	Sensation.
Dumfries Model.	Colonel Slaney.
Conquering Hero.	Talisman.
General Roberts.	Dalmeny Argon.
Dalmeny Helium.	Scottish Monarch.
Highlander.	Engineer.
Superlative.	Motor.

II.—*Varieties closely resembling British Queen.*

Pioneer.	Russet Queen.
Dalmeny Radium.	The Macpherson.
The Colleen.	

III.—*Varieties similar to Abundance* (Sutton's).

Maid of Coil.	Dalmeny Gem.
Diamond.	Scottish Queen.
Conqueror.	Twentieth Century.
Ireland's Best.	

The three following are also closely allied: Special, Crofter, Sir John Franklin.

IV.—*Varieties similar to Charles Fidler.*

Lord Dundonald.	Sirdar.
Table King.	Rival.
Monarch.	

V.—*Varieties similar to Maincrop* (Clarke's).

Langworthy. Good Hope.
What's Wanted.

VI.—*Varieties similar to Royal Kidney* (Findlay's).

Dalmeny Acme. New Guardian.

VII.—*Variety similar to Golden Wonder.*

Peacemaker.

VIII.—*Varieties similar to Duke of York.*

Maxim. Midlothian Early.

Many growers who have purchased these variously named potatoes and compared them with their old kinds, have perhaps seen some differences between them, such as shade of foliage, length of haulm, period of ripening, cooking qualities, and cropping power. But these differences are, it is believed, chiefly due to the source from whence they are obtained, or in other words, the previous history of the seed. The results gained by the before-mentioned "change of seed" show what may be expected from that alone.

Space will not permit of a discussion of the merits of the many varieties tested, but it will be of interest to give the names of the twelve most productive kinds in the year 1906.

Variety.				Total crop. Tons.	Cwt.
Up-to-Date.	From	Cromarty	1906	16	19
Table Talk	,,	Lothians	1905	16	9
Tyne Kidney	,,	,,	1905	15	15
Factor	,,	,,	1906	15	13
Dalhousie	,,	,,	1906	15	16
Dalmeny Regent	,,	Dalmeny	1906	15	10
British Queen	,,	Lothians	1905	14	17
Engineer	,,	Belfast	1905	14	14
Premier	,,	Lothians	1905	14	10
Dalmeny Beauty	,,	Dalmeny	1906	14	9
Northern Star	,,	Lothians	1906	14	8
Dalmeny Hero	,,	,,	1905	14	0

With the exceptions of Tyne Kidney, British Queen, Northern Star, and Premier, all of the foregoing were of the Up-to-date type (Group I.). Premier was badly affected with disease and of poor quality, turning very black when cooked.

Two of the most important types, Abundance and Maincrop, representing Groups III. and V. respectively, are not shown in the first twelve in order of yield. Two members of Group III. yielded 11 tons 7 cwt., and five of Group V. varied in yield from 12 tons to 10 tons 15 cwt.

The following figures give the average yield for three years, 1905, 1906, 1907, of the most important types. From these results we may gauge the relative yields of the various groups.

Group.	Variety.	Total crop. Tons.	Cwt.	Ware. Tons.	Cwt.	Diseased. Cwt.
I.	Up-to-Date	14	18	11	2	11
	Table Talk	15	4	12	0	11
	Factor	14	4	11	2	18
II.	British Queen	13	17	10	11	4
V.	What's Wanted	10	18	8	0	0
VI.	Royal Kidney	11	7	8	0	0
	Northern Star	15	0	8	16	1

Group I.—These potatoes are fair quality, subject to disease, and heavy croppers.

Group II.—This group is of good quality, also subject to disease, and for second earlies crops very well.

Group V.—Medium croppers, best quality, and practically no disease.

Group VI.—Poor quality, medium yield, but nearly immune to disease.

Northern Star, heavy cropper, poor quality, practically no disease.

Early varieties of potatoes have not received so much attention at Cambridge as the later ones, but each year several of the leading kinds have been tested. The most extensive trial of early sorts was in 1906, when the best in point of yield were :—

	Tons.	Cwt.
Southern Queen	9	14
Epicure	8	12
Sharpe's Express	8	1
Midlothian Early	7	17

As the result of the tests made at Impington, the following varieties are recommended :—

First Earlies.—For quality the Duke of York type is still hard to beat, but is not so early as May Queen. Potatoes of this type are not very heavy yielders compared with Southern Queen, Epicure, or Ninetyfold. The last-named variety is one of the earliest and a very heavy cropper, but the flesh is not firm enough.

Second Earlies.—The British Queen type (Group II.) is still the most profitable second early to grow in districts

which are not very subject to disease. But should *Phytophora infestans* be very prevalent, either Royal Kidney or King Edward may be preferred before it. The quality of these last two is much inferior to that of the British Queen.

Late Varieties.—The ideal potato is yet to be found, though there is a large list of varieties to be had. At present none of them combine the three necessary factors which make an ideal potato. These factors are quality, quantity, and disease resistance. Any two of these can be correlated, but not at present all three.

The *Up-to-Date* type (Group I.) stands out as the best cropper, coupled with fair to good quality, but lacks the immunity to disease.

The *Maincrop* types (Group V.) are suitable for rich soils in districts affected with disease, as they are practically immune, and are of the best quality possible, but these again are lacking in yielding power.

The *Northern Star* (a type by itself) combines the features of heavy cropping powers with comparative resistance to disease, but in this case the quality is somewhat deficient, and it grows too large a proportion of small potatoes.

The grower must, therefore, decide which one of the three characters (which go to make "the perfect potato") he can afford best to dispense with in his own district and for his own requirements.

The figures given above relating to the weight of the crop of different varieties represent in all cases the yield per acre.

THE FORMATION OF HYDROCYANIC ACID FROM LINSEED CAKE.

G. D. LANDER, D.Sc., F.I.C.,
Royal Veterinary College, London.

THE occurrence of cyanogenetic glucosides in linseed has been long known, and the work of Dunstan and Henry (*Proc. Roy. Soc.*, B. 78, 1906, 145) established the identity of this substance with phaseolunatin, the glucoside of Java beans. The linseed contains the same enzyme, capable of resolving the glucoside, which is also chemically resolved by 10 per cent. hydrochloric acid.

Regarding the occurrence in linseed cakes, the same

authors (*Jour. Board of Agric.*, Mar., 1908, 729) quote two commercial cakes which gave total hydrocyanic acid 0·035 and 0·041 per cent. respectively. But they clearly emphasise the important question of "availability" of the poison, showing that no acid is formed on maceration with cold water, the enzyme having been, presumably, destroyed by the heating during process of manufacture. With such cake there can hardly be any question of poisoning, since there is no evidence to show that the glucoside is poisonous, or that it is resolved by digestive ferments or those contained in other foods.

Cakes are, however, often met with which yield "available" hydrocyanic acid, by which it is to be clearly understood that maceration with cold water produces free hydrocyanic acid. In such instances it is probable that part of the original enzyme has escaped destruction by heat. It has been found that fermentation goes on in 1 per cent. hydrochloric acid and also in 1 per cent. sodium bicarbonate solutions, and would not therefore be inhibited by the body fluids. The development of acid is, moreover, complete on twelve hours' digestion in water at 12° C. None of the cakes examined here contained more than 0·025 per cent. of available acid. Dr. Voelcker has kindly informed me of several cakes examined by him of which the lowest gave 0·0046 per cent. or 0·321 grains per pound, the highest 0·051 per cent. or 3·57 grains per pound. My own specimens averaged 0·025 per cent. Dr. Voelcker's 0·051 per cent. sample was a Calcutta cake, and he was informed that sheep refused it, unless kept without other food.*

The maximum noted by Dunstan and Henry (*loc. cit.*) for Java beans is 0·123 per cent., and it might therefore, bearing in mind the fairly rapid evolution of acid, be anticipated that linseed cakes, especially such as the one noted by Dr. Voelcker, might prove injurious, possibly even fatal. Taking cake of 0·025 per cent. hydrocyanic acid, a daily ration of 1 lb. for a sheep means a daily dose of 1·75 grains of acid, slowly evolved during digestion. A 2-lb. ration for a heifer would represent 3·5 grains of acid per diem. The medicinal doses are for the sheep $\frac{1}{3}$, for horse or ox $\frac{5}{6}$ grain.

By the courtesy of Col. Duncombe and Mr. E. G. Haskell,

* See also *Journ. R.A.S.E.*, 1909, p. 342.

M.R.C.V.S., we were able to carry out feeding tests on sheep and on a heifer, which had for their primary object the elucidation of obscure cases of blindness affecting heifers. Incidentally, it was hoped to solve the question of the harmfulness or otherwise of the cake.

The results are here briefly summarised (HCN = Hydrocyanic acid):—

I.—A sheep had 1 lb. cake (0·025 per cent. HCN) per diem for 36 consecutive days. No result.

II.—A sheep had 1 lb. for 31 days; 5 lb. for 2 days; and after 7 days a further 5 lb. No result.

III.—A heifer (six months) had:—

1 lb. per day dry cake for 4 days.
1 lb. per day moist cake for 13 days.
2 lb. per day moist cake for 2 days.
5 lb. per day moist cake for 18 days.

14 days' interval.

5 lb. per day moist cake for 30 days.

Total 261 lb. cake in 67 days equal to 456·75 grains of hydrocyanic acid.

No definite results having been obtained, the cake was discontinued, and after about six weeks acid in the form of pure potassium cyanide (KCN) was fed as follows:—

KCN equiv. to 3·5 grains HCN in ordinary food 4 days.
KCN equiv. to 7·0 grains HCN in ordinary food 1 day.
KCN equiv. to 10·0 grains HCN in ordinary food 1 day.

Interval 2 days.

KCN equiv. to 15·0 grains HCN in ordinary food 2 days.

Total 61·0 grains HCN in 10 days.

No obvious results were got. The animal at first refused the larger doses, but ate the food within an hour.

Fifteen grains hydrocyanic acid were then fed with 7 lb. of bran in one feed, and next day a further 15 grains, in this case liberated from the salt by an equivalent amount of dilute hydrochloric acid. No notable result was got.

After eight days, cyanide equivalent to 22·5 grains hydrocyanic acid were given in a gentian ball inserted into the rumen, and as no notable result ensued next day 30 grains were similarly administered. This proved fatal within two hours.

THE STEMLESS OR CHALK THISTLE. (*Cnicus acaulis.*)

From these observations it may be concluded that cake such as that used is harmless. Variation due to idiosyncrasy is possible, and a cake of 0·05 per cent. would in an 8-lb. feed give 28 grains of prussic acid, equal to a 4-lb. feed of Java beans showing 0·1 per cent. acid.

There seems no ground to suppose that hydrocyanic acid is cumulative. Indeed, for a poison so volatile and easily eliminated this would not be anticipated. Similarly when gradually developed hydrocyanic acid could probably be taken in larger quantities than would kill in one dose. The general evidence of our experiments is against the supposition that tolerance or habituation is established, but one cannot regard this as definitely negatived.

Poisoning by giving linseed has been known and recorded, and our results cannot be taken as absolutely exclusive of the possibility with cakes, especially with sheep. In this connection a test on sheep with a 0·05 per cent. cake and a determination of the toxic dose of the pure drug would be most desirable.

The Stemless or Dwarf Thistle.

THE Stemless or Dwarf Thistle (*Cnicus acaulis,* Willd.), is sometimes termed the Chalk Thistle from its habit of growing freely in pastures over chalk. It may be at once recognised by its spreading rosette or tuft of very prickly smooth leaves, its almost stemless or sessile flower-heads, and its extensively creeping rootstock (See plate). It is a perennial which sometimes occurs plentifully in dry pastures over gravel and chalk in the southern and central midland counties of England. The rosettes of leaves destroy the patch of herbage which they cover, and when the weed is plentiful, extensive damage may be done.

The creeping rootstock and almost stemless character of this thistle combine to make its eradication extremely difficult, for it is a perennial which during the summer months manufactures a large amount of food material in the leaves and stores it below ground in the root system. It is not tall enough to be cut with the scythe or similar implement, and it sometimes occurs in such numbers that continual spudding is a most tedious and expensive operation. Spudding, how-

PERENNIAL SOW THISTLE (*Sonchus arvensis* L.). $\times \frac{1}{3}$.

ever, is the only practical mechanical remedy, and should be repeated throughout the summer months, the object being to induce the plants continually to send up new shoots for removal with the spud, thus gradually exhausting the stores of food in the rootstock and preventing the formation and storage of a fresh supply. An endeavour should at the same time be made to improve the general herbage by manurial treatment, and thus crowd out the low-growing thistle. Isolated patches might be dealt with by covering them with large sheets of strong tarred paper, securely fastened down with pegs and large stones. Light is excluded, and all vegetation beneath the paper is destroyed. The bare spots would need reseeding with grass and clover seeds afterwards.

The Perennial or Corn Sow Thistle.

The Perennial or Corn Sow Thistle (*Sonchus arvensis,* L.) attains a height of 2 to 4 ft.; the stem is tubular and angular, and clothed with yellow sticky hairs in its upper part; the leaves are wavy and toothed, but very variable; and the heads of yellow flowers are rather hairy, and 1 to 2 inches in diameter. It spreads both by seed and by a creeping rootstock. The flowers open in August and September. The Perennial Sow Thistle is a vigorous grower, occurs on most soils in arable land, and may occasion great trouble and damage. Its presence is frequently manifested in corn crops in late summer, when the large yellow flowerheads are very conspicuous. It may be at once distinguished from the Annual species in the mature stage by means of its extensively creeping rootstocks and much larger flowers. (The Annual Sow Thistle was described in the *Journal* in June, 1909, p. 207.)

In order to combat this weed, seeding must be prevented by cutting the plants just before they reach the flowering stage. During the summer the plants manufacture a large amount of food-material in their leaves, and this is transferred and stored below ground in the roots and root buds. To cut off the stems of this pest *after* this storage has taken place has no exhausting effect on the crop, and cutting once or twice *late in the season* can be practised for years without diminishing its vigour. *To cope with the Corn Sow Thistle it*

must be cut early in the year, soon after it comes above ground, and the cutting should be repeated as frequently as possible throughout the season. For every shoot sent above ground the thistle uses some of its stored material, and if the stems and leaves, which are the plant's machinery for making more food, are destroyed as soon as they appear, exhaustion and death will certainly result. Both old and young plants must be dealt with in this way. A short rotation, with thorough cultivation and the free use of the hoe in two or three successive root crops, is perhaps the most certain means of killing this pest.

Badly infested land may be laid down to grass for a few years, when the weed will be crowded out. Small patches of this weed may be dealt with in the same way as in the case of the Chalk Thistle, by covering them with large sheets of strong tarred paper.

Heavy crops of lucerne, vetches and maize tend to crowd out thistles of all kinds, and where it can be grown successfully maize is especially useful, as it casts a dense shade and is also thoroughly hoed.

Effect on Milk of Water or Watery Food given to Cows.

Alleged Indirect Adulteration of Milk.—The attention of the Board was called during the past year to notices in the Press as to the conviction of a dairyman in the French Courts for selling adulterated milk. This conviction was based on the assumption that it is possible to water milk either by feeding cows on watery food, or by causing them to drink water in large quantities, or immediately before being milked. The Board were not aware of any sufficient evidence to show that when the total supply of nourishment is sufficient it is possible to increase the quantity of the milk, at the expense of the quality, by these means; and as they considered that the dissemination of incorrect information on this subject among Officers of Local Authorities and others might lead to hardships to dairymen, they referred the matter to the Agricultural Education Association, and arranged with them to

conduct experiments at the Midland Agricultural and Dairy College to test the points raised.

Seven typical dairy cows were selected from the College herd. They were of the dual-purpose Shorthorn type. These cattle were stall-fed during the whole of the time the experiment was in progress. Their food consisted of concentrated and dry fodders with the addition of mangolds, and at stated intervals, viz., every seventh day, it was supplemented with a definite amount of salt.

The amount of water taken daily was measured by allowing each cow to drink from a graduated vessel. During the first week access to water was continuous, during the second intermittent. Milking was regularly and expeditiously undertaken, the interval between successive milkings being ten and fourteen hours, evening and morning respectively. The effect of the salt was to be determined by the variation in the yield of milk and its quality. The latter was done by sampling the milk from each cow at each milking, and analysing the milk for fat and solids during the same day.

The cows were numbered 1 to 7, and the scheme was mapped out in days. On the first day cow No. 1 received four ounces of salt, on the second day cow No. 2 was salted, and so on. Thus one day in each week a cow received salt, and on every day of that week some one cow was receiving salt. For the first seven days each cow had free access to a measured quantity of water. In the second week she was allowed to drink only just before being milked. In the third week water was free, on the fourth intermittent. From the experience gained in the first two weeks the experiment was altered so that instead of giving four ounces of salt in one meal, three ounces were given after the night's milking on one day and three ounces after the morning's milking on the next day. The feeding of six ounces of salt caused purging.

The result of the experiment appeared to show that periodical doses of common salt administered to cows, even to the extent of purging them, do not necessarily cause them to consume excessive quantities of water; and that the amount of water consumed by cows has no direct bearing on the composition of their milk yield.

Agricultural Education in the United States and Canada.

The University College, Reading, has recently issued the report of a deputation appointed by the Council to visit Canada and the United States with a view to examining and reporting on the systems of agricultural research and education in operation in those countries. The deputation consisted of Mr. S. Sutton, Mr. E. A. Mansfield, Principal Childs, Professor Keeble, and Mr. Hart Synnot. The report merits the attention of all who are interested in agricultural education in this country.

The deputation confirmed what many previous observers have stated as to the superior efficiency and organisation of the agricultural colleges in Canada and America.

Many accounts of these institutions have been published, but some of the outstanding facts will bear repetition. For example, the single State of Ontario subsidises the Guelph College of Agriculture to the extent of £25,000 annually. The material return for this outlay is officially stated to be :— "The application of scientific principles to the practical operations of the farm, and the interchange and dissemination of the results of experiments conducted at the College, and the practical experience of successful farmers, have increased the returns from the farm far in excess of the expenditure on account thereof. The direct gain in yield in one class of grain alone has more than covered the total cost of agricultural education and experimental work in the Province."

In relation to the College buildings, a novel feature is described, but one which distinguishes nearly all the transatlantic colleges, a stock-judging pavilion with accommodation for 300 persons. The need for a better knowledge of the points of good stock seems to be generally recognised in Canada and the United States, and experts are employed to demonstrate on the subject in these pavilions. At the Guelph College the staff numbers about fifty, many members being exclusively employed in demonstrating to parties of visitors. One of the chief functions of the College is to be "an aggressive distributor" of the best agricultural ideas and methods, and that this function is gratefully appreciated by farmers is shown by the fact that some 40,000 visitors are

welcomed at the College annually. In addition, experimental work is carried out on plots on nearly 5,000 farms, as well as on the College farm. Another building which is not to be found in agricultural colleges in this country is a machinery hall, containing specimens of all the most modern types of agricultural machines.

Another remarkable institution is the Macdonald College, in the State of Quebec, built and endowed by Sir William Macdonald at a cost of nearly one million sterling. The site (including the farm) covers 560 acres, and the buildings are on the same scale of magnificence as the Ontario College. In the case of both these Colleges no students are admitted who have not worked for at least one year on a farm.

In addition to teaching institutions, the Canadian Government maintains a central experimental farm at Ottawa, where a staff of workers is continuously engaged in experimental and advisory work. The amount of work done in the latter capacity may be gauged by the fact that about 50,000 letters of inquiry are received and answered every year.

The Reading deputation also visited the famous Cornell University at Ithaca, New York State, and here again we have the same tale of seemingly unlimited expenditure on agricultural education. The buildings and equipment of the agricultural department here cost £80,000, but a scheme involving the expenditure of £250,000 is under consideration. The College farm extends to 1,000 acres. Tuition is free to regular students. The staff of lecturers and assistants numbers 70, organised in 20 departments, and 968 students attended in the session of 1909-1910. Bulletins are regularly distributed gratis to 5,000 farmers, and leaflets on domestic economy are issued annually to farmers' wives, and on Home Nature Study to teachers and to boys and girls, in very large numbers. The Wisconsin College is organised on similar lines, and its activity is as pronounced.

These two colleges are not exceptional institutions. Each State in the Union possesses a well-equipped agricultural college financed by Federal as well as by State grants, the former being restricted to aiding current expenditure only, for it is a cardinal principle of the Central Government that the capital outlay must be provided by the States,

whereas Federal grants can only be used in aid of working expenses.

The Reading deputation proceeds to discuss the position of agricultural education generally in the U.S.A. and Canada. It is justly observed that, apart from the criterion of results, no one can dispute or disregard the magnitude of the scale on which the colleges are conceived and the enterprising energy which animates their work. The great differences between agricultural problems in these countries and those existing here (in, for example, climatic and racial conditions) cannot, of course, be ignored, and constitute a permanent difficulty in the way of utilising foreign experience in promoting education and development in Great Britain; but when all is said there remains a substratum of similarity which may be profitably explored in furtherance of British agriculture. A factor which has fostered development in America and Canada is found in the fact that the trans-atlantic farmer is not, on the average, so skilled as the British, and is consequently more in need of instruction. Agricultural education here will not be successful until a large body of specialists of proved ability and scientific skill is placed at the service of the farmer. The failure to gain the entire confidence of the farmer, which is an unfortunate feature of the position of higher agricultural education in this country, may unquestionably be attributed to this fact. The Reading deputation is convinced that in Canada and the United States the colleges have completely gained the confidence of the agriculturist, and the report is devoted in part to considering how the Reading College can attain this happy result in the area which it serves. Among the desiderata placed before the governing body of the College, the following deserve mention:—

A greater specialisation on the part of the members of the staff is called for. In the words of the Report of the Departmental Committee on Agricultural Education: "Teachers must be trained specialists." The provision of facilities for post-graduate research is urgently required. The time given to the teaching of pure science should be curtailed, and more attention should be given to practical subjects. "The main function of the agricultural college is to teach the best methods of farming." Students of all grades must be agriculturists

first, and men of pure science afterwards. The deputation recommends that the first two years of the course should be devoted to definitely agricultural subjects, explained and illustrated with reference to elementary scientific facts. In the third year of the course, optional lines of specialisation should be provided. Particularly to be commended is the recommendation that a portion of the College farm should be set aside for the demonstration of a typical branch of local agriculture.

In regard to research the deputation does not formulate definite proposals. The opinion is, however, strongly expressed that teaching and research must go hand in hand.

The concluding portion of the report is devoted to an examination of the existing relations between the College and the County Councils, and after condemning them as unsatisfactory, puts forward an ambitious scheme designed to secure complete co-operation. The appointment to the College staff of a number of specialists for advisory work only is advocated. Some of the subjects for which experts may be required are management of grass-land, cereal growing, plant diseases, &c.

Finally, the report deals with the question of finance, and urges the necessity for ample State aid. "Canada and the United States are setting standards in agricultural education which we cannot ignore or belittle. In *personnel,* in energy and ability, the old country holds her own. But she is behindhand in the generosity inspired by faith. The sums allotted to universities and university colleges are not only much smaller than those given for similar purposes in other countries, but good work is left undone, opportunities are lost, and efficiency is retarded and impaired through sheer want of the necessary ways and means."

Miscellaneous Imports and Exports of Agricultural Produce.

In addition to the imports of agricultural products mentioned in last month's issue of the JOURNAL (p. 816), there are some other articles of importance, which may be referred to as of interest to the agricultural industry. The figures for these are given on the next page.

The value of the agricultural articles of British production

and manufacture exported amounts in the aggregate to a considerable sum, although taken individually they do not usually represent a very extensive trade. The information,

IMPORTS.

Description.	1909.	1910.	1909.	1910.
	cwt.	cwt.	£	£
Wood and Timber	—	—	23,591,579	26,198,854
Tallow and Stearine	2,196,556	2,462,767	3,359,962	4,194,487
Hides :				
Dry	468,993	516,941	1,602,094	1,855,911
Wet	737,602	763,925	2,185,974	2,416,630
Manures :	tons.	tons.		
Basic Slag	15,286	16,588	25,927	26,895
Bones, burnt and unburnt ...	39,031	44,505	175,672	201,539
Guano	20,321	20,395	89,147	107,958
Nitrate of Soda	90,207	126,498	860,860	1,161,127
Phosphate of Lime and Rock Phosphate	451,807	455,553	747,367	722,456
Oil Seed Cake...	328,763	316,630	2,130,394	2,105,839
	cwt.	cwt.		
Seeds, Clover and Grass ...	319,001	286,976	727,605	664,158
Flowers, fresh	—	—	244,855	229,798
	No.	No.		
Horses	16,774	14,674	580,624	530,108

available for the past year, is summarised in the next table. The various commodities included under the heading of corn, grain, and flour represent a total of £3,418,000, while meat of all kinds, including live cattle, bacon, hams, poultry, and game, account for £938,000. Wool from British flocks was exported to the value of £1,929,000, while hides and undressed skins accounted for £1,758,000.

EXPORTS.

Description.		1909.	1910.
		£	£
Grain and flour		3,399,004	3,417,546
Meat (including animals for food)		797,203	937,821
Wool	lb.	62,269,200	36,973,300
	£	2,750,065	1,929,245
Hides and undressed skins... ...	£	1,916,634	1,758,277
Manures	tons	764,193	821,929
	£	4,380,731	4,920,862
Oil-seed cake	tons	110,470	176,294
	£	678,166	1,092,779

Two items of importance, viz., manures and cake, are included in the table, though they are not agricultural products. In the case of manures, 822,000 tons were sent from

these shores, representing a value of £4,921,000; about one-third of this, viz., 284,000 tons, was sulphate of ammonia, while the balance was made up of 153,000 tons of superphosphate, 232,000 tons of basic slag, and 153,000 tons of

Description.		Quantity.		Value.	
		1909.	1910.	1909.	1910.
ANIMALS LIVING—FOR BREEDING:		Number.	Number.	£	£
Cattle	To United States of America	1,090	1,701	24,229	39,154
	,, Uruguay	160	179	13,786	14,911
	,, Argentine Republic .	694	694	87,326	74,876
	,, Channel Islands . .	1,652	—	25,996	—
	,, Australia	44	97	2,874	6,194
	,, Canada	223	212	5,418	7,361
	,, Other Countries . .	518	599	20,226	28,397
	Total . .	4,381	3,482	179,855	170,893
Sheep and Lambs	To Germany	497	675	4,697	5,763
	,, United States of America	735	1,577	4,825	9,096
	,, Uruguay	100	167	1,551	2,647
	,, Argentine Republic .	1,735	770	43,524	14,145
	,, Australia	66	92	1,299	866
	,, New Zealand . . .	39	103	1,138	3,431
	,, Canada	3,475	3,811	22,155	20,609
	,, Other Countries . .	771	644	6,926	6,001
	Total . .	7,418	7,839	86,115	62,558
Swine	To Argentine Republic .	63	13	663	325
	,, Canada	11	21	93	163
	,, Other Countries . .	671	817	6,418	8,535
	Total . .	745	851	7,174	9,023
Horses	To Netherlands	19,069	19,957	215,260	223,578
	,, Belgium	28,374	30,206	329,607	390,873
	,, France	3,004	2,354	146,093	115,437
	,, Other Countries . .	5,463	6,633	387,524	564,350
	Total . .	55,910	59,150	1,078,484	1,294,238
ANIMALS OF OTHER KINDS—Not for Food		65,162	66,789	43,459	53,590

other kinds of artificial manures. Oil-seed cake has shown an exceptional development during the last two years. In 1908 the export was only 16,478 tons valued at £95,000, in 1909 it was 110,500 tons worth £678,000, and in 1910 this further increased to 176,000 tons representing £1,093,000. The

increase is confined to "other sorts" (not specified), but may not improbably have been soy-bean cake.

Perhaps the most interesting item in the export trade, from an agricultural point of view, is that which shows the sales of breeding animals to the Colonies and foreign countries. In the table on p. 917 the particulars are given for the past two years, but it should be noted that the figures for 1909 include some animals exported for use as food, the number and value of which are not ascertainable. In the case of cattle, for example, the animals exported to the Channel Islands would come chiefly under this heading.

The export of cattle, if those sent to the Channel Islands are excluded, showed a marked increase, chiefly to the United States. The export of sheep was also somewhat larger, the number sent to the United States having doubled, while the Canadian demand showed some growth. On the other hand, there was a substantial diminution in the export to Argentina.

Horses, however, represent the largest item in this export trade, and the total value in the past year is the largest yet recorded.

Dry Farming.

The recently issued Bulletin of the Dry Farming Congress in America will be perused with interest by agriculturists in this country. It gives an interesting glimpse into transatlantic ideas and methods. The expression "Dry Farming" is intended to be descriptive of the systems of farming best suited to semi-arid regions. The phrase is, however, loosely applied to successful systems of farming followed in places with an annual rainfall of less than thirty inches, and where, consequently, the fundamental problem is how to conserve the soil moisture to a degree sufficient to enable cereals to be grown with success. In Western America, and Canada, there are many thousand square miles of land in regard to which this problem arises, and is now being successfully solved.

The solution does not involve any new principle: it depends simply on the well-known efficacy of a surface mulch, or fine division of the soil, in preventing evaporation. Thus, the fundamental principles of dry farming

are stated to be deep initial preparation of the ground, and constant after-cultivation. Where the annual rainfall is less than fifteen inches, this mulching process is kept up during a "summer fallow," and it is alleged that in this way the rainfall of two seasons may be conserved for the purposes of one crop.

Whatever the true explanation of its success may be, it cannot be doubted that the system of summer fallowing with repeated surface tillage has made it possible to obtain good crops of cereals in spots which a few years ago were marked on the maps as "desert." The credit of this discovery, or rather of this application of well-known principles to the arid regions in America, is largely due to a pioneer farmer, Mr. Campbell, of Dakota, who not only successfully applied the method to his own lands, but also by his unremitting missionary efforts has largely contributed to the spread of the new knowledge in the Western States of America and Canada.

The enthusiasm to which this discovery gave rise is characteristically American, and affords an object-lesson of the greater keenness with which new knowledge is followed by our transatlantic cousins. The new cult, as it may appropriately be called, gave birth in time to an International Dry-Farming Congress, of which the fifth meeting was held in October last at Spokane, Washington. The objects of this Congress are thus defined in the "Constitution":—"To encourage a better understanding of the methods by which dry-land farming can be successfully conducted; to create a great co-operative educational propaganda on behalf of agricultural development; to encourage the teaching of the basic principles of the science of farming in public schools; to push the dry-farming propaganda into every district of the world, in order that the millions of now unoccupied acres of arable land may be utilised as homes for the landless . . . &c."

The Congress meets annually and occupies three days. At the last meeting, the members were addressed by upwards of fifty speakers, including State Governors, Professors of agriculture, and farmers, the subject in every case being some practical aspect of farming.

In reading these addresses one cannot fail to be struck by the enthusiasm and eagerness to learn shown by the

members. In this connection it must be remembered that the average American farmer is frequently unacquainted with the elementary facts connected with the rotation of crops and manuring, which seem to the British farmer inseparable from ordinary agricultural practice. There is, consequently, a wide field for the energies of the Congress in the direction of spreading a knowledge of the rudimentary principles of good farming.

Sugar Beet Industry on the Continent.

In continuation of the article on the cultivation of the sugar beet in last month's JOURNAL, a memorandum drawn up at the Netherlands Department of Agriculture, Industry, and Commerce, transmitted by Lord Acton, First Secretary to the British Ministry at The Hague, furnishes some interesting particulars. Twenty-nine beetroot sugar factories were in operation in the Netherlands in 1909, and dealt with the yield of 136,000 acres. The beetroots are delivered by the farmers to the nearest canal or railway station. The prices have ranged from 17*s*. a ton in 1906 to a maximum of 22*s*. a ton in 1910. In 1909 the pulp was sold for 5*s*. 11*d*. per ton if delivered free at the place of destination, and 4*s*. 8*d*. per ton if fetched from the factory by the purchaser.

The cost of some of the operations connected with cultivation and delivery is given as follows:—

Sowing sugar beet, about 1*s*. 4*d*. per acre.
Weeding, thinning, &c., about £1 per acre.
Lifting, about £1 to £1 6*s*. 8*d*. per acre.
Loading into waggons or boats, about 3*d*. per ton.
Harbour dues, about 3½*d*. per ton.

The wages vary with the season, but are largely made up of piece-work. The average in South Holland is said to be about £33 a year for an ordinary labourer. Rent may be put at approximately 45*s*. to 50*s*. per acre on a seven-year lease, but this covers the payment by the landlord of polder and other dues, which are considerable. The State land tax of 6 per cent. on the estimated rent is also paid by the owner. Local land taxes do not exist, and agriculture is exempt from the State tax on professional incomes.

Hesse (*Germany*).—Another interesting report by the manager of a sugar beet factory in Hesse is transmitted by H.M. Chargé d'Affaires at Darmstadt. The sugar beet crop in Hesse this year was both large and rich in sugar, owing to the sunny October. All along the Rhine from Mainz to Worms the Dutch sugar factories have been buying sugar beet direct from the farmers, and have outbid the local factories by about 4*s*. a ton; high prices are also expected next season owing to this competition. The beet is transported by water, on the Rhine, to Holland.

The average content of sugar in the beet this year in Germany is 16·76 per cent. The amount of sugar is said to depend chiefly on the quality of the seed supplied to the growers by the factory; secondly, on the average summer temperature, and the amount of sun; and, thirdly only, on the manuring and cultivation of the beet in the fields.

In the Gross-Umstadt factory, which is worked partly on the co-operative system, the co-operative members receive 19*s*. 4*d*. a ton and 40 per cent. of the weight of the beet in fresh beet clippings, free for fodder, regardless of the amount of sugar. After making up the balance-sheet, an additional payment will probably be made based on the amount of sugar above 14 per cent., so that the farmers will receive about £1 2*s*. a ton for beet containing 16·76 per cent. of sugar. The farmer's receipts work out at about £14 9*s*. per acre, in addition to the value of the beet clippings and the green tops for fodder.

Farmers who are not co-operative members receive about £1 1*s*. 4*d*. per ton of pure beet regardless of sugar content, but do not get free clippings.

The highest yield in Gross-Umstadt was about 18 tons per acre, and the lowest a little under 10 tons.

According to official statistics of the Hessian Government for November, 1910, the four sugar factories in the province, during the year ended August 31st last, dealt with 190,000 tons of beetroot grown on 14,700 acres. The produce per acre was thus nearly 13 tons. The average price of the beetroot bought was 19*s*. 10*d*. a ton. In all, 23,000 tons of raw sugar were produced—that is, about 12 per cent. of the weight of beetroot. In other words, about 8¼ tons of beetroot were required to produce one ton of raw sugar.

Improvement of Agriculture in Sweden.

Apart from education and research, the system of State aid in Sweden may be said briefly to represent the encouragement of individual effort by grants to societies and associations which are managed by the members on lines prescribed by regulations made by the Ministry of Agriculture.

Although much variation exists, the organisation under the Department of Agriculture may be said to centre in the Societies of Rural Economy, of which there is one, or sometimes two, to each Province. These are responsible for the agricultural interests of their district, and are the official representatives of agriculture locally. They act as the intermediaries between the Government and the farmer in all matters relating to the promotion of agriculture. Their income is derived, to a limited extent, from the subscriptions (usually very small) of members, from a grant made from the tax on alcoholic liquors, and from State subventions. These funds are in turn used for making grants to other societies for special purposes, and many of the State subventions are distributed through these Provincial Societies, on the condition that they contribute an equal amount from their own funds. The purposes for which these subventions are given are very numerous, but among them may be mentioned the following:—

Seed Control Stations.—There are 17 Stations, established by the Provincial Societies, which receive small grants from the State, not exceeding £55 each annually. They test the purity and germination of seed at certain fixed charges, and give advice to farmers and seed merchants.

Chemical Stations for the Analysis of Fertilisers and Feeding Stuffs.—These are often attached to the Seed Control Stations, and receive grants in the same way. In both cases the staff, methods of testing, scale of charges, etc., have to be approved by the Department of Agriculture.

Butter Control.—In order to maintain the reputation of Swedish butter abroad, a system of examining butter intended for export was adopted in 1909. The butter from each dairy is examined without notice three or four times a year, and if it is found to come up to the standard the dairy is allowed to use a special registered trade-mark.

Stations for Testing Machines and Implements.—Two Stations were established in 1897 by means of a fund placed at the disposal of the Department of Agriculture by a private firm, in order to enable new types of machinery to be tested and publicly reported on, either by request of the maker only or by direction of the Committee. The original fund has now been exhausted, but the work is continued by means of State grants.

Society for the Cultivation of Marsh and Moor Land.—This Society, of which an account was recently given in this Journal (June, 1910, p. 210), receives a grant of £2,000 from the State, and £840 from the Provincial Societies. It maintains an Experiment Station, publishes a journal, and generally encourages the rational cultivation of moor land throughout Sweden.

Society for the Improvement of Seeds.—This Society, the work of which is chiefly centred at the well-known Svalof Seed Station,* is devoted to the work of introducing improved varieties of farm seeds by means of selection. It receives a grant of £2,200 from the State and £840 from the Provincial Societies.

Premiums for Small Farms.—Annual competitions for these, limited to holdings not exceeding 30 acres, are organised by the Provincial Societies, all the factors which contribute towards good management being taken into account in awarding the prizes. In addition small so-called "loans" are granted to prize-winners in certain cases for the purpose of effecting necessary improvements in the holding, but if the work is carried out satisfactorily repayment is not required. In 1908 the number of competitors was 1,372, of whom 897 received awards, and in addition 471 received "loans." The cost of the prizes amounted to £3,300, of which about £3,000 was provided by the State, while the "loans" amounted to £1,400.

Live Stock Breeding.—Horse- and cattle-breeding are chiefly encouraged by giving prizes for approved breeding animals. In the case of horses the premiums range from about £14 for stallions to 28*s.* for a young mare, and the number of animals which received recognition in 1908 was

* For a full description of this station see *Journal*, August, 1910, p. 379.

7,715. The cost, amounting to £17,000, was nearly equally divided between the State and the Provincial Societies.

The premiums for cattle are especially intended to encourage breeding among small farmers, and are, therefore, only offered to occupants of 125 acres at the most. The greatest importance is attached to milk-producing qualities, and in judging bulls the characteristics of their offspring and ancestors are taken into account. On account of lack of funds, the prizes for cows have in many cases been given up, but small holders are encouraged by the distribution of tickets entitling their cows to service by an approved bull.

These competitions are considered to have a great influence on the improvement of cattle-breeding, particularly by drawing attention to the great importance of employing good bulls. The Provincial Societies place farmers in the way of purchasing good specimens, and the prizes awarded, together with the service tickets which are paid for by the Committee, make the keeping of a bull a profitable business in many districts. Some 68,000 of these "service tickets" were distributed in 1908, and the number of animals entered in the competitions was 60,000. The premiums amounted to £15,000, towards which the State contributed £5,500. The Provincial Societies also grant loans to local associations of small farmers who keep bulls for their common use, and assist them in other ways.

Another method of encouraging cattle-breeding is the recognition of so-called "breeding centres." These are herds of approved cows which are subject to strict supervision with a view to building up a strain of heavy-milking cows and distributing their descendants over the district.

Subventions are also given to several stud and herd book societies, and also to the Society for the Promotion of Poultry-keeping.

Milk Control Associations.—These are widely distributed in Sweden, the number exceeding 650, and they receive grants of £2,300 from the State and £2,500 from the Provincial Societies. Through their operations they have improved the average yield of milk and have at the same time led to a more economical and more rational method of feeding.

Loans for Small Holdings and the Improvement of Land.—

Several funds exist from which loans can be granted to the Provincial Societies or to other associations for the purchase of small holdings, or for the drainage and reclamation of marsh land.

Co-operative Associations.—Apart from the societies mentioned above, there are some 800 co-operative associations, with 40,000 members, for the purchase of farm requisites, about 500 co-operative dairies, 200 associations for the sale of eggs, and some for other purposes, but these do not generally receive any assistance either from the State or the Provincial Societies.

SUMMARY OF AGRICULTURAL EXPERIMENTS.

EXPERIMENTS WITH LIVE STOCK.

Inheritance of Horns and Face Colour in Sheep.—Sheep Breeding by Mendelian Methods (*Jour. Agric. Science*, Vol. I., Part 4, March, 1906, and Vol. III., Part 2, October, 1909).—In 1903 an experiment was begun by Professor T. B. Wood to follow out the inheritance of various characters in sheep. Suffolk ewes were crossed with a Dorset horn ram, these breeds being selected as possessing certain well-marked characteristics, *i.e.* Suffolk sheep of both sexes, black faces and no horns, and Dorsets of both sexes, white faces and large horns. In order to simplify the experiment the face colour and horns alone were considered, all other characters being neglected. The experiment was of a preliminary nature, the purpose being to study the possibility of work on Mendelian lines with large animals, rather than to produce results of economic importance. The results were of considerable interest from this point of view, but they indicate clearly the difficulty of experimental work with large and slow-breeding animals. The purity of males as regards Mendelian characters can be quickly tested by mating with a number of ewes, but it must be several years before a female bears enough lambs for it to be seen that she breeds true. Another difficulty is the complicated nature of what it was hoped would prove to be simple characters, such as horns and face colour. Points of economic importance such as would be likely to appeal to the butcher, the dealer, or the wool merchant, are hardly likely to turn out less complicated than these.

Feeding of Cattle (*Univ. Coll. of Wales, Aberystwyth, Agric. Dept., Bull.* 1).—The object of this experiment, carried out in 1908–9, was to compare the value of different quantities of concentrated food in the daily ration. In the previous winter, 1907–8, a set of experiments showed that heavy feeding was unprofitable, 6 lb. of concentrated food giving as good results as 10 lb., at a less cost. The present trial was designed to show whether less than 6 lb. per day could be profitably fed.

Two lots of ten bullocks, viz., six Herefords and four Welsh, were fed for sixteen weeks, from December 4th to March 26th, on the same daily allowance of 5 lb. chopped straw, 10 lb. hay, and 50 lb. roots;

but while one lot was given in addition 6 lb. of concentrated food, viz., 3 lb. of equal parts of decorticated and undecorticated cotton cake, and 3 lb. of barley meal, the other lot was given only half the quantity at first and later 4 lb. The cost per week for the former lot was 6*s.* 6*d.*, and for the latter 5*s.* 3*d.* At the end of the sixteen weeks it was found that the gain made by each lot was practically the same, so that in this case the smaller allowance of concentrated food was more profitable. The growth made by the cattle was not very satisfactory, but Professor Bryner Jones considers that the results show that when cattle are liberally supplied with turnips, and sufficient hay and straw to enable them to make the best use of the turnips, they will feed as well on 3 lb. of concentrated food as on double the quantity.

An interesting point arose in connection with the fact that the cattle had no access to water at the commencement of the experiment. It was not intended that they should be given water at all, but during the last month it was thought better to supply them with as much water as they required, and possibly in consequence of this there was quite a remarkable increase in live-weight in both lots during that period.

Rations with and without Water (*Univ. Coll. of Wales, Aberystwyth, Agric. Dept., Bull.* 1).—This experiment, carried out in 1909–10, was suggested by the effect of allowing the cattle access to water in the foregoing experiment, which seemed to show the necessity of supplying more water than is contained in 50 lb. of turnips per day. Two lots of five cattle each, four Shorthorns and one Blue-grey, were used in the experiment. From December 13th to April 5th they were given a ration composed of 50 lb. roots, 10 lb. hay, ¾ lb. linseed cake, ¾ lb. undecorticated cotton cake, 6 lb. chopped straw, and 1½ lb. barley meal. In the second half of the period an additional 1 lb. of concentrated food was given. During the month before the experiment neither lot was allowed access to water, but after December 13th the animals in Lot I. were allowed water freely. The results showed that there is a distinct advantage in giving water to cattle receiving not more than 50 lb. of roots per day. The average live-weight gain in sixteen weeks made by those given water was 1 cwt. 104 lb., while the average gain made by the others was 98 lb. The number of cattle used was small, and consequently the result is affected by one animal without water, which lost 63 lb. in the last month. The unsatisfactory progress of this lot, however, appears to be mainly due to the lack of water. When water has been withheld from cattle for some time, the increase in live-weight for some time immediately after they are given access to it again is likely, according to these experiments, to be very rapid, but this rate of increase is not maintained for more than about three or four weeks.

Feeding of Pigs with Cooked and Uncooked Potatoes (*Univ. Coll. of Wales, Aberystwyth, Agric. Dept., Bull.* 1).—This was a continuation of two experiments comparing cooked and uncooked potatoes for pig-feeding, which had shown that the trouble and expense of cooking were not on the whole justified by the slightly better results from feeding cooked potatoes. In this case three pigs (large Yorkshire–Berkshire cross) were given daily 2½ lb. barley meal and 3½ lb. boiled potatoes (Lot I.), and three other pigs (Lot II.) the same quantities but with the potatoes raw. This feeding lasted six weeks. The potatoes given to Lot I. were boiled at the beginning of each week, and were

supplied cold. The potatoes for Lot II. were pulped after being thoroughly washed. In both lots the potatoes and meal were mixed with water and then supplied to the pigs, the same quantity of water being used in each case. The three pigs fed on raw potatoes made a gain in live-weight of 1 cwt. 73 lb., while the three on boiled potatoes made 1 cwt. 98 lb.

If 1*s.* per week is allowed as the cost for fuel and labour in boiling, the balance in favour of the boiled potatoes (Lot I.) is estimated at 2*s.* 6*d.*, but Professor Bryner Jones remarks that the trouble and inconvenience of cooking food for pigs is, in many cases, a much more serious consideration than the actual cost of fuel and attendance, and if a price were set on this, it is doubtful whether it would not frequently be found much more profitable to feed pigs on raw potatoes than this experiment would seem to show.

Fattening of Sheep and the Residual Manurial Value of Feeding Stuffs (*Cornwall C.C., Report on Cattle Feeding*, 1907 *and* 1908).—An experiment is in progress for the purpose of testing the residual value of purchased feeding stuffs consumed on pastures by sheep. Up to December, 1908, about one ton each of linseed cake, cotton cake, and maize had been consumed on three plots, and the difference between these plots and one receiving nothing is very marked. An interesting point is that the maize plot appears to be improving as rapidly as the cotton cake plot, thus suggesting that the manurial value does not differ so greatly as the Lawes and Gilbert tables indicate.

Feeding Cattle with Different Amounts of Swedes (*Northumberland Agric. Expt. Station, Cockle Park, Bull. No.* 15).—Trials on the feeding of cattle with different quantities of swedes, and also without roots, have been in progress at Cockle Park since 1901, and the results for 1907–10 are reported in this Bulletin.

In these trials several of the leading concentrated foods and fodders were substituted for the swedes fed to fattening and store cattle, and on the whole the results were practically equal. It seems, therefore, to be quite possible to substitute concentrated foods and fodders in cases where swedes are not available. When this is done equivalent food nutrients should be given.

From these results it may be assumed that the nutritive matter in swedes, calculated from the German standards, is to a large extent equal to the same amount of nutritive matter in our more common cakes, meals, and fodders. In these trials the rations have been calculated on the basis of the Wolff-Lehmann feeding standards for ruminants. These are based on the amounts of the various constituents of food which are actually digested by ruminants, and not on the total amounts of constituents in the foods. At the same time it must be recognised that many foods have a particular value, because some of the feeding constituents contained in them are specially suitable for certain classes of animals.

The swedes were valued at 6*s.* 8*d.* per ton, but the cost of the substituted foods was in each case greater by several shillings. At current prices, however, swedes are worth more than 6*s.* 8*d.*, so that the difference in cost was probably not great.

Soy Bean Cake for Feeding (*Northumberland Agric. Expt. Station, Cockle Park, Bull. No.* 15).—Trials with this cake in 1909–10 showed

that it was an excellent food for different kinds of stock. In all cases it was tested with decorticated cotton cake, because that cake gave better results than linseed cake and several other oil cakes at Cockle Park. For fattening cattle and dairy cows soy bean cake gave quite as good results as decorticated cotton cake, but it did not do quite so well for fattening sheep or for young store cattle. It is important to note that soy beans, containing over 17 per cent. of oil, gave a better result with fattening sheep than soy bean cake containing about 7 per cent. of oil. The larger amount of oil present in the beans has, therefore, had a considerable feeding value.

Fattening Cattle.—Twelve blue-grey cattle, just over eighteen months old, were divided into two lots and fed in boxes at Cockle Park. The trials commenced on November 26th, 1909, and continued for four months. Each beast in Lot I. received on the average 4 lb. decorticated cotton cake daily throughout the trials, while each beast in Lot II. received on the average 4 lb. soy bean cake daily, in both cases along with other foods. On the average each beast in each lot gained 12 lb. weekly, so that the feeding results with the two cakes were exactly alike, and each lot was equally ready for the butcher at the close of the trials. As the cost of the soy bean cake was considerably less than that of the decorticated cotton cake the financial result was considerably in favour of feeding with soy bean cake.

Young Store Cattle.—Eighteen blue-grey calves, just over six months old, were divided into two lots and put on winter rations, which were identical, except that Lot I. received $1\frac{3}{4}$ lb. decorticated cotton cake daily and Lot II. $1\frac{3}{4}$ lb. soy bean cake daily. The trials commenced on November 27th, 1909, and continued for twelve weeks. The stirks receiving decorticated cotton cake gained $6\frac{1}{6}$ lb., and those receiving soy bean cake 5 lb. a head weekly. Both lots were in excellent store condition at the close of the trials. As the cost of the soy bean cake was less than that of the decorticated cotton cake the financial result at the end was only to a small extent in favour of decorticated cotton cake.

Fattening Sheep.—Forty-eight three-parts bred hoggs were fed in the sheep-house at Cockle Park, and were divided into three lots, sixteen in each lot. The trials commenced on November 23rd, 1909, and continued for ten and a half weeks. The average rations fed were identical, except that Lot I. received $\frac{2}{5}$ lb. decorticated cotton cake daily, Lot II. $\frac{2}{5}$lb. soy bean cake daily, and Lot III. $\frac{2}{5}$lb. soy beans daily.

The results were that those receiving decorticated cotton cake gained 2·34 lb. a head weekly in live-weight, those receiving soy bean cake 1·75 lb. a head weekly, and those receiving soy beans 2·04 lb. a head weekly. The average live-weight of each animal during the trial was 130 lb. When the prices of the two cakes and the soy beans are taken into account the financial results do not differ to any extent, and all the sheep were in good fat condition at the close. The extra oil contained in the beans was evidently of value for sheep feeding.

Milch Cows.—Trials were conducted on the effects of these two cakes on milch cows at Newton Rigg, the Cumberland and Westmorland Farm School, under the supervision of the manager, Mr. W. T. Lawrence.

Trials with six cows were commenced on February 6th, 1909, and continued for twelve weeks. The cows each received 4 lb. soy bean cake for the first and last three weeks, and 4 lb. decorticated cotton cake for the middle six weeks, in each case along with other identical foods. The results were practically the same; the amount of milk produced, the amount of fat contained in the milk, and the live-weight of the cows, not differing appreciably. As, however, the cost of the soy bean cake was considerably less than that of the decorticated cotton cake, the financial result was in favour of the former.

A comparison of the effects of feeding milch cows with decorticated cotton cake and soy bean cake was carried out at Offerton Hall, the County Durham Dairy Research Station, for fourteen weeks from January 2nd till April 9th, 1910. Five lb. soy bean cake were fed daily per head to one lot of five cows and 5 lb. decorticated cotton cake daily to another lot of five cows. In each case the cake formed part of an otherwise identical daily ration of roots, fodder, &c. The feeding of the two lots of cows was reversed at the end of the first seven weeks.

The results were that practically the same amount of milk was given by each lot of cows, and the percentage of fat present in the milk was practically the same in the two lots throughout the trial. Both lots of cows lost in weight during the first seven weeks of the trials, but gained in weight during the last seven weeks. The effects of the cakes on the two lots of cows were therefore practically the same throughout the trial.

Comparative Feeding Values of Meadow Hay and Oat Straw (Northumberland Agric. Expt. Station, Cockle Park, Bull. 15).—This experiment was carried out in the winter of 1908–9. Its object was to test the comparative feeding values of meadow hay and oat straw as grown at Cockle Park. A feeding trial was carried out with two lots of six cattle, and from the results it was calculated that with oat straw at 35*s.* a ton, the relative value of meadow hay is just about 60*s.* a ton. In other words, oat straw was found to have seven-twelfths, or a little more than a half, the value of hay.

In the trial the deficiency of feeding constituents in the oat straw as compared with meadow hay, was made up by adding Indian cotton cake and maize meal to the former, the feeding value of the various foods being calculated by the Wolff-Lehmann feeding standards, and it is remarked that the results showed how nearly correct these feeding standards are. They show also that very many foods can be substituted for each other, provided the rations contain equal amounts of digestible food constituents.

DAIRYING EXPERIMENTS.

Manufacture of Early-Season Cheeses (*Univ. of Leeds, Bull. No.* 77).—The value of early-season cheeses is usually lower than that of the later made ones, chiefly on account of the absence in the former of the ideal flavour, aroma, colour, and sometimes texture. The flavour and aroma of these early-season cheeses may become strong, and the colour is impaired by the appearance of reddish brown spots or of whole "tracks" of a colour varying from yellow to almost black. The latter discolorations are generally along the lines of cracks and fissures,

and are indicative of moist places, while "spot" discolorations occur irregularly distributed in what otherwise appear to be drier and sounder cheeses. Cheeses affected in this way were investigated chemically and bacteriologically, and the results are given in this Bulletin.

As a result of these investigations the following practical suggestions are made for the prevention and remedy of these faults in early-season cheeses: (1) A milk and curd infected with a minimum number of fault-producing ferments should be obtained; (2) suitable temperatures and suitable amounts of rennet should be employed to ensure a good-textured cheese; (3) sufficient numbers of acid-producing ferments or organisms should be developed to ensure the production of an agreeable, sharp, clean-smelling acid type of fermentation, and to ensure an inhibitory effect on the objectionable functions of other organisms that might be present; (4) about one-half per cent. carbohydrate (sugar) should be added to the curd at or before salting.

The Milking and Butter Trials at the Dairy Show of 1909 (*Jour. Brit. Dairy Farmers' Assoc., Vol.* 24, 1910).—In the milking trials of 1909 113 cows of seven different breeds were tested, and also twenty-three goats. The cows were milked at 6.30 a.m. and 5.30 p.m. The milk yielded during two days was weighed, and both the morning's and evening's milk of the first day was analysed. For the purpose of the competition points are given to each animal for the yield and quality of milk, with an allowance for the time elapsed since calving. The most interesting fact in a table showing the average number of points gained by different breeds during each of the last ten years is that a gradual improvement has taken place in the milking qualities of the Pedigree Shorthorns entered. In 1900 the average number of points gained by the Pedigree Shorthorns was 72·4, and since then the number has risen fairly steadily to 97·5 in 1909. In this report a record is included of the milk given by each of the cows and goats, and tables showing the yield and composition of the milk of the different breeds, and the number of samples that were deficient in fat or other solids. Similar figures are given of the performance of the cows entered for the butter tests.

Milk Records (*Edinburgh and E. of Scotland Coll. of Agric., Bull.* 19).—Records of the yield and composition of milk of the dairy herd at the County Asylum, Rosslynlee, have been kept since 1905. The milk of each cow is weighed daily, and tested for fat once a week, and the purpose is to use the information so obtained to improve the herd by selection and breeding. In the year July, 1908, to July, 1909, the average milk yield was less than in the previous year, but this was due to a number of changes in the herd—several of the heaviest milkers had to be dispensed with on account of age or other reasons. Considering only the cows that were in the herd for a complete year, or the greater part of a year, the yield of the heaviest milker was 10,695 lb., with an average percentage of fat of 3·68, while the lowest yield was 5,984 lb., with 3·20 per cent. of fat. The average of thirteen cows was 7,888 lb. of milk, containing 3·72 per cent. of fat. The introduction of home-bred cows into the herd continues; there are at present two in the herd, and two other heifers were expected to calve in 1909-10. The process of improvement has not, however, gone very far yet, as there are twenty-two cows altogether in the herd.

A table is given in the report showing the number of times that the weekly sample of milk of each cow contained less than 3 per cent. of fat. The hours of milking were 5 a.m. and 4 p.m. throughout the year, giving intervals of 13 hours and 11 hours between milkings. In spite of these intervals being more nearly equal than is usual, the number of times the milk of single cows contained less than 3 per cent. of fat was 113 at the morning's milking, *i.e.*, after the longer interval, compared with 36 at the evening's milking. The cows varied greatly in this respect; one fell below 3 per cent. 24 times in the morning, and 8 times in the evening; another 11 times in the morning and 4 in the evening; while a number of others were deficient only 2 or 3 times altogether. The weekly samples of the mixed milk of this herd never contained less than 3 per cent. of fat, but when this does occur with other herds it should apparently not be difficult to make an improvement by getting rid of the cows that offend most often.

An investigation was also carried out as to the effect of the temperature and ventilation of cow-houses on the yield and composition of the milk and the health of the stock. This was one of a series of experiments organised by the Highland and Agricultural Society of Scotland, which was noticed in the *Journal*, October, 1909, p. 550, and December, 1909, p. 755.

MISCELLANEOUS EXPERIMENTS.

The Feeding Value of Different Kinds of Roots.—The following note on this subject has been furnished to the Board by Mr. F. Bagge, Commissioner to the Swedish Board of Agriculture. The experiments are reported in Bulletin No. 16, published by the Central Swedish Experiment Station.

Roots take a very prominent part in the feeding of cattle in Sweden, and many investigations have been made into their value for this purpose. Extensive experiments were carried out during the winter to ascertain if the yield of milk would be affected by feeding roots containing varying percentages of dry matter. The total quantity of dry matter in the roots given to the cows was the same throughout. The experiments during two years were carried out with 120 cows, divided into 20 groups. Of these groups 11 received beetroots, 4 swedes, 3 turnips, and 2 carrots. In connection with the tests a great number of analyses of the roots were made in order to ascertain the composition of the dry matter in the roots. The general conclusions arrived at from these tests are as follows :—

1. Apart from the varying percentage of sugar in the roots, the dry matter in the different kinds of roots has shown upon the whole the same composition.

2. The quantity of digestible albumen in turnips, beets, and swedes seems, according to the analyses, to be between 0·4 and 0·5 per cent.

3. No difference was found in the influence of the various roots upon the percentage of fat in the milk, nor upon the live weight of the animals.

4. The difference in the yield of the cows fed on different kinds

of roots was so slight that the dry matter in ordinary roots must be regarded as of practically the same feeding value.

The value of the roots for practical purposes must therefore be calculated according to their dry matter, and the class of root to be selected for cultivation must be that which is found to give in this respect the biggest crop. It must also fulfil requirements as to keeping qualities and also as regards harvesting.

Inheritance in the Potato (*Journal of Genetics*, Vol. I. No. 1).—The new *Journal of Genetics*, edited by Mr. Bateson and Prof. Punnett, contains an interesting and valuable article on inheritance in the potato. The author is Dr. Salaman, a new worker in the field of heredity, who has devoted the last four years to the study of heredity in the potato. The result may be regarded as a new triumph for the Mendelian theory; for Dr. Salaman has shown that the inheritance of such characters as shape, depth of eye, and colour of skin—all characters of economic importance—follow Mendelian lines. Further, there are indications that susceptibility and immunity to disease are probably Mendelian "factors," and may yield to the treatment which, in the hands of Professor Biffen, has been so successful in producing a rust-proof wheat. The problems to which the discoveries of Dr. Salaman give rise are, however, of a more complex character than in the case of wheat. It is well known that the seed of the domestic varieties of potato does not come true; in other words, these varieties are hybrids in the Mendelian sense. The importance of Dr. Salaman's work lies in the fact that if the various characters—such as the colour of the tuber—in which the seedlings differ from one another be examined, it is found that they can be arranged in pairs, and the inheritance of each pair is independent of the inheritance of the others. For example, if two varieties possessing shallow eyes be crossed, the seedlings of the cross will all have shallow eyes; but if deep-eye be crossed with shallow-eye, either one-half of the offspring will be deep-eyed and one-half shallow-eyed, or all the offspring will be deep-eyed, showing that deep-eyes and shallow-eyes are a pair of Mendelian characters, of which the former is dominant.

The feature of Dr. Salaman's work which is of the greatest economic importance is found in his experiments on *Solanum tuberosum*, a variety of potato which is useless for domestic purposes, but which is believed to be absolutely immune to potato disease. Seedlings raised from this potato are apparently of two kinds, one susceptible to disease and the other immune. If it should prove that susceptibility and immunity are Mendelian characters which segregate, then the possibility of producing a potato immune to disease and at the same time fit for domestic use at once emerges. It is needless to say that the economic advantages of such a variety would be as incalculable as the losses which result from the liability to disease of practically all the domestic varieties now under cultivation.

A Russian Method of Corn Cultivation.—The experiments mentioned in this *Journal* (December, 1909) as having been carried out in Germany with a view to testing the efficacy of the method of corn cultivation advocated by M. Demtschinsky, have been continued during 1910, and the results are reported in the *Mitteilungen der Deutschen Land.-Gesellschaft* (November 19th, 1910).

The plan of the experiments differed slightly from that of the preceding year. Duplicate plots were again arranged with rye and barley. The rye plots were arranged as follows:—(*a*) Drilled in the ordinary way in rows 6 in. apart, 110 lb. seed per acre; (*b*) planted in rows 8 in. apart, with 6 in. between the plants, which were afterwards transplanted and deep-set; (*c*) drilled in rows 8 in. apart, 55 lb. seed per acre; (*d*) drilled as in (*c*), the plants afterwards being earthed up.

As regards the effect of weather, plots (*d*) were most injured by frost, while the plants on (*c*) grew strongly and proved better able to withstand frost. The plants on (*b*) suffered from drought as in the preceding year, and by April 10th, 1910, only 48 per cent. of the original plants survived on one of the plots, and only 21 per cent. on the duplicate plot. Hoeing on (*c*) and earthing up on (*d*) took place on October 14th, 1909.

In respect both of length of ear and number of grains in the ear the plants obtained by the ordinary method of cultivation were inferior to those of (*b*), (*c*), and (*d*), but the individual excellencies of the plants on the last three plots were not sufficient to compensate for the deficiency in numbers compared with plot (*a*), and the greatest yield was obtained from the customary drilling with double the amount of seed (plots *a*) as shown in the following table:—

Cultivation.	Rye.		Barley.	
	Grain, bushels (60 lb.) per acre.	Straw, cwt. per acre.	Grain, bushels (50 lb.) per acre.	Straw, cwt. per acre.
a. Ordinary cultivation.	47·8	51·9	46·6	35·8
b. Transplanted	17·7	21·4	—	—
c. Deep set	45·7	52·6	53·4	34·6
d. Earthed up	40·5	48·0	54·1	32·2

With rye, therefore, the experiments again showed the ordinary method of cultivation to be most suitable even without taking into account the extra labour involved in the Demtschinsky system.

In the case of barley, three methods of sowing were adopted—(*a*) ordinary drilling 6 in. apart, 130 lb. seed per acre; (*c*) drilled in rows 8 in. apart, 3 in. deep, 65 lb. seed per acre; (*d*) as in (*c*), the plants being earthed up. As will be seen from the above table, the yield of barley was greater where transplantation and earthing up methods were employed than where the ordinary system was adopted. On the other hand, an experiment is mentioned as being carried out at Erlau with barley in which the ordinary method of cultivation was found to give the greatest yield.

Mineral Content of the Leaves of Fruit Trees (*Die landw. Versuchs-Stationen,* Band lxxiii., Heft vi.).—This publication contains an account of experiments conducted in 1907, 1908, and 1909 by the Experiment Station for Plant Physiology at Dresden, to determine the relative amounts of various substances in the leaves of fruit trees. Trials were carried out with cherry, pear, apple, and plum trees of the same age (planted in 1890) standing on a grass-grown sandy soil. Removal of

the leaves took place in dry weather and at the same time of day, those selected being uninjured, of average size, and formed in the spring. The leaves were weighed before and after drying, and were then reduced to powder, the weight of the various substances in the powder being determined.

In 1907 the leaves were removed at the end of May, and the amount of nitrogen, potash, lime, phosphoric acid, and ash in the dry matter of the leaves was shown to be the greatest in the case of plum trees.

During 1908 removal of the leaves took place at four periods of the year, namely, (1) just after the appearance of the leaves (beginning of May), (2) middle of June, (3) end of August, (4) shortly before the fall of the leaves, *i.e.*, after they had begun to lose colour.

		Water.	Dry matter.	Percentage of Dry Matter.				
				Nitrogen.	Potash.	Lime.	Phosphoric Acid.	Ash.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Pear	9 May ...	75·90	24·10	4·087	2·460	0·754	1·357	6·908
	22 June ...	62·53	37·47	2·282	1·690	1·977	0·414	7·157
	29 August ...	59·90	40·10	2·041	1·770	3·147	0·406	9·454
	2 October ...	52·99	47·01	0·917	1·321	3·473	0·158	9·552
Apple	9 May ...	78·18	21·82	4·152	3·160	1·186	1·299	8·304
	22 June ...	69·60	30·40	2·628	1·886	2·166	0·562	8·017
	29 August ...	64·24	35·76	2·015	1·927	2·762	0·475	9·166
	15 October ...	56·85	43·15	1·198	1·601	3·723	0·288	10·889
Cherry	14 May ...	78·81	21·19	4·867	3·006	1·511	1·386	9·006
	22 June ...	68·82	31·18	2·639	2·782	2·699	0·692	10·510
	29 August ...	62·97	37·03	2·160	2·637	3·987	0·752	12·319
	2 October ...	67·31	32·69	1·022	3·080	4·558	0·625	14·446
Plum	18 May ...	79·09	20·91	4·917	2·774	1·026	1·171	7·369
	22 June ...	73·51	26·49	3·208	4·887	3·512	0·699	15·031
	29 August ...	68·31	31·69	2·398	5·221	4·591	0·662	17·757
	30 September	72·12	27·88	1·152	5·825	5·696	0·451	20·987

The results of the experiments in 1908 are shown above. It will be seen that the water-content of the leaves decreases with their age, until autumn is reached, when, in the case of cherries and plums, the water content increases again. This was also found to hold good for pears and apples in the next year of the experiment, when the leaves were not removed until three weeks later in the year. The proportion of lime and ash in the leaves increased, that of nitrogen and phosphoric acid decreased as the leaves became older. In the case of nitrogen and phosphoric acid the decreases were most marked in the period from the beginning of May until the end of June, *i.e.*, at the time when these materials are most required in the formation of the fruit. The amount of potash decreased in the case of pears and apples, increased in plums, and remained fairly constant in cherries. The high content in potash of the leaves of the plum tree in autumn (5·825 per cent.) would make them valuable as a manure.

Analyses were made in 1909 in the same way of the mineral content of the leaf buds and fruit blossoms of cherry and plum trees, with the result that the fruit blossoms showed a larger content of water than

the leaf buds and a larger percentage of nitrogen and potash in the dry matter, but a smaller percentage of lime, phosphoric acid, and ash.

The experiments during 1909 were also conducted with a view to ascertaining whether the substances in the leaf return into the tree in the autumn before the fall of the leaf. Conclusive evidence was obtained in support of this view in the case of nitrogen and phosphoric acid. While the amounts of these substances in the leaf remained fairly constant up to the penultimate analysis, a marked decrease was shown in the period between the penultimate and the last analysis, the last analysis being made at the end of October or at the beginning of November, when the leaves came away easily from the tree at a touch. The decrease in the amount of dry matter during the last stage of the experiments was also most noticeable (except in the case of plums), and decreases were the rule during the last period with potash and lime. This return of material from the leaf into the tree appears, however, to be dependent upon the weather. Such a return will take place if summer conditions extend far into autumn, while if cold weather occurs early the leaves fall too soon to admit of this return taking place.

Use of Formalin for Smut (*Praktische Blätter für Pflanzenbau und Pflanzenschutz,* November, 1910).—Experiments with regard to the treatment of the seed of cereals with formalin for the prevention of smut have been carried out during the last ten years by Professor Jaczewski, at the Russian Agricultural Phytopathological Institute, and the following recommendations are made as a result of his experiences in this direction.

The seed should not be too old. The older the seed, the more easily does it absorb the formalin solution, and the germinating capacity is liable to be injured by the formalin reaching the germ.

The formalin solution should preferably be weak, say, 0·15 per cent., or one pint of 40 per cent. formalin to 38 gallons of water. This solution is practically identical with that recommended in the Board's Leaflet, No. 92, viz., one pint of formalin to 36 gallons of water.

The seed should not be left to steep for too long a time, but Prof. Jaczewski regards a period of about two hours as most suitable for disinfection, and states that this will not injure germinating capacity. A period of ten minutes is suggested as sufficient in the Board's leaflet. The treatment by immersion is somewhat inconvenient, however, and a better method is to collect the seed in heaps, and spray with the above solution, each heap being turned, so that all the seed receives treatment. When this is complete, the seed should be covered over, left for two hours, and then spread out to dry. Further particulars of this method will be found in the leaflet already referred to.

Experiments on this subject have also been mentioned at some length in this *Journal,* Vol. IX., p. 366, Vol. XI., p. 214, and Vol. XII., p. 289.

Time of Harvesting Peppermint for the Production of Oil.—The most important stage in the cultivation of plants grown for the production of volatile oils, such as peppermint, is probably the harvesting of the crop. In order to determine at what stage of development the amount of odorous constituents of the plant is at its maximum, both as regards quantity and quality, and thus to decide at what period the

harvesting may most profitably take place, some experiments have been carried out in the United States, and are mentioned in Bulletin No. 195 of the Bureau of Plant Industry of the United States Department of Agriculture.

The oil of the peppermint plant owes its characteristic fragrance to esters, which admit of being measured quantitatively with some accuracy. In the experiments mentioned, distillations for oil were carried out at three different stages—(1) before flowering of the plant (or in the budding state); (2) at flowering; and (3) after flowering (or during the fruiting stage), with the following results:—

Stage of Growth.	Yield of Oil.	Ester Content as Menthyl Acetate.	Alcohol Content as Free Menthol.
	Per cent.	Per cent.	Per cent.
Before flowering (July 22) ...	0·23	9·5	31·0
At flowering (Aug. 21)	0·20	14·5	23·6
After flowering (Sept. 25) ...	0·10	24·0	34·0

The aromatic quality as represented by the percentage of esters increased gradually during growth, but the yield of oil decreased very markedly in the case of plants harvested after the flowering period. The oil was noticeably more fragrant in the "after flowering" stage than at the two previous periods.

From these experiments, it would seem that to delay the harvesting until the "after-flowering" stage would increase the quality of the oil, but that this would be accompanied by a decrease in quantity. Both these factors are affected by the handling and partial drying of the plant before it enters the still, and a comparison of results obtained from fresh and dry plants, distilled after an interval of five months, showed that the latter yielded 63 per cent. less oil than the fresh. This marked decrease is probably in part due to the long period of drying, but it indicates a general tendency to a loss of oil as a result of drying, and it is therefore desirable that distillation should take place immediately after harvesting.

Similar experiments were also made with bergamot and wormwood.

OFFICIAL NOTICES AND CIRCULARS.

The President of the Board of Agriculture and Fisheries has appointed a Council to advise the Board on all matters pertaining to the encouragement and improvement of the horse-breeding industry.

Advisory Council on Horse Breeding.

The Council is constituted as follows, and is appointed for a term of four years:— H.R.H. Prince Christian of Schleswig-Holstein, K.G., The Duke of Portland, K.G., The Marquess of Tullibardine, M.P., the Earl of Granard, K.T. (Master of Horse), the Earl of Dalkeith, the Earl of Erroll, K.T., the Earl of Fortescue, A.D.C., the Earl of Donoughmore, the Earl of Minto, K.G., the Viscount Helmsley, the Lord Middleton (Chairman), the Lord Ribblesdale, the Hon. Alexander Parker, Colonel

the Hon. Charles Byng, the Right Hon. A. E. Fellowes, Sir Merrik Burrell, Bart., Sir Gilbert Greenall, Bart., Sir John McFadyean, Major-General J. F. Brocklehurst, C.V.O., &c., Algernon Turnor, Esq., C.B., Major A. L. Langman, C.M.G., J. Blundell, Esq., J. Cooper, Esq., D. Davies, Esq., G. Dove, Esq., Professor J. C. Ewart, Major W. H. Fife, T. Gilbey, Esq., Captain J. Gilmour, J. Hill, Esq., C. C. Hurst, Esq., Colonel H. Lewis, Major J. McKie, G. N. Midwood, Esq., J. L. Nickisson, Esq., Professor Penberthy, F. Lort Phillips, Esq., W. Phillpotts-Williams, Esq., I. Ramsay, Esq., E. P. Rawnsley, Esq., G. G. Rea, Esq., J. S. Rigg, Esq., A. H. Smith, Esq., J. H. Stokes, Esq., R. Stratton, Esq., R. S. Tilling, Esq., C. W. Tindall, Esq., R. Whitehead, Esq., and J. Williams, Esq.

The Right Hon. Lord Middleton is the chairman, and Mr. E. B. Wilson, of the Board of Agriculture and Fisheries, and Mr. A. B. Charlton are the joint secretaries.

Meetings of the Council will be summoned from time to time as occasion may require, and will be attended by such officers of the War Office, the Department of Agriculture and Technical Instruction for Ireland, and of the Board themselves, as may be nominated by their respective departments, to take part in its deliberations, and to supply information or give explanations with regard to any questions that may be raised.

The Council is empowered to appoint committees to consider and advise upon particular sections of the subject.

Preliminary Memorandum as to the Duties and Procedure of County Committees in relation to Horse-breeding.

The business of a County Committee in this connection will in the main consist of making the local arrangements for carrying out or supervising the provisions of the Board's scheme :—

(*a*) As regards King's premium and Board's premium stallions;

(*b*) For the distribution of free nominations to mares for service by premium stallions;

(*c*) As regards the purchase of brood mares; and

(*d*) For promoting the voluntary annual registration of stallions by owners of stallions of all recognised breeds.

An outline of the procedure to be followed by a County Committee in connection with the various matters falling to be dealt with is set out below :—

Premium Stallions.—King's premium stallions will for the present be selected at a spring show to be held in London. Board's premium stallions may ultimately be selected at local spring exhibitions, but for the present they will be selected on application made direct to the Board.

Immediately after the award of a King's premium at the spring stallion show the Board will arrange with the owner of each stallion the precise location of the stallion in the district as regards which the premium has been awarded, and will communicate their decision to the Secretary of the County Committee or Committees concerned.

The acceptance of a King's premium brings the owner of the stallion under an obligation to allow his horse to serve not less than fifty half-bred mares, if required, at a fee not exceeding 40*s*. for each mare and

2*s*. 6*d*. groom's fee, but where the owner of the mare presents a free nomination ticket (as to which see later) no fee other than the groom's fee is payable by the owner of the mare. The owner of the stallion is also required to allow his horse to serve any mare for which a free nomination ticket has been issued to the owner of the mare by the Board, and also, if so required, to serve any brood mare which has been purchased and leased to a farmer or other person in accordance with the Board's horse-breeding scheme. The above service fees will not, however, be paid to the owner of the stallion in any one season in respect of more than ninety mares.

It will fall to the County Committees concerned to arrange for the formation of a local committee or committees in each of the districts into which the country is divided for the purpose of the awarding of premiums to stallions (*see* Appendix),* to undertake the settlement of all questions connected with the premium stallions located in their district during the season of service, which extends from April 1st to July 31st, and to arrange for the allocation of a limited number of free service tickets to owners of mares. The collection of fees will be a matter for the owners of the stallions to arrange. For the purpose of appointing these committees some co-operation may be necessary between the County Committees of the counties comprised in any one of the nineteen districts above referred to.

Board's Premium Stallions.—In the case of Board's premium stallions which are to be selected locally, requirements similar to those applicable to King's premium stallions will be enforced as regards the obligations of the owner of the stallion, with the exception that the fee to be charged to the owner of a mare will be limited to 20*s*. and 2*s*. 6*d*. groom's fee, and upon the award of a Board's premium the County Committee or Committees concerned will be asked to make arrangements on similar lines to those to be made for King's premium stallions.

Pony Stallions.—The Board have also in view the granting of a limited number of premiums of less value for pony stallions where it is thought by a County Committee that they would be beneficial on conditions yet to be decided upon.

Free Nominations for Mares to Premium Stallions.—Under the premium system as described above the charge to the owner of a mare for the services of a stallion is limited to £2 in the case of a King's premium stallion and £1 in the case of a Board's premium stallion. By means of the award of free nominations the whole cost of the service fee will in a limited number of cases be provided by the Board and paid direct to the owner of the stallion; the only charge payable by the owner of the mare will be the groom's fee, 2*s*. 6*d*. Funds will be available for the payment of about 800 nominations to King's premium stallions, value £2 each, and 650 nominations to Board's premium stallions, value £1 each, annually. A County Committee will, with the advice of a veterinary surgeon, be asked to allot the free nominations for mares in their district. In selecting mares for the award of free nominations it is desirable that the following points should be kept in view:—

As far as possible preference should be given to the small occupier or

* Not printed.

person possessing a good class of mare who otherwise might be expected to use an inferior and possibly unsound stallion. Preference might properly be given in cases where an owner of a mare has served or is serving in any of his Majesty's Territorial Forces, but it is not intended that more than one nomination for mares shall be given to any one person in any year. The selected mare must in all cases be the *bonâ fide* property of the applicant. A free nomination will in no case be transferable, and it is desirable that free nominations should be given only where the applicant is prepared to accept one for the *best* of his young mares. Mares more than eight years old should not as a rule be selected.

It is important that precautions should be taken to ensure, as far as possible, that mares receiving free nominations are not barren. Mares showing substance and quality are to be preferred. Each mare selected must be certified by a qualified veterinary surgeon to be free from hereditary unsoundness or defects and otherwise fit for breeding purposes. The Board think it most desirable that free nominations should be distributed in a county as widely as possible, due regard being had to the location of the premium stallions. A County Committee may always at their discretion refuse to give a nomination to any mare without assigning any reason.

The necessary forms for the selection of the stallions by the owners of mares, and also the service tickets, will be supplied by the Board to the Secretary of the County Committee.

For the purpose of rendering a list of the names of owners of mares selected for free nominations a form (H^{15}) will be supplied for the use of the Secretary of a County Committee, to be returned to the Board in due course, but it is desirable that a short reserve list ot eligible mares should also be available in the event of any nomination becoming void. The Committee should fix a date before and after which applications for free nominations will not be entertained by them and communicate this date to the Board.

The owner of the nominated mare is required to insert on the prescribed application form the name of the stallion by which he wishes to have his mare served, and to return the form to the Secretary of the County Committee. Any alteration or erasure on a service ticket must be initialled by the Secretary of the County Committee, otherwise the claim for service cannot be recognised or accepted by the Board.

On receipt of such application form, arrangements should be made for a veterinary examination of the mare, where necessary, and the Secretary should also communicate with the owner of the selected stallion, in order to satisfy himself that the list of that stallion is not already full. The conditions of service (Form H^{33}) should at the same time be sent to the stallion owner. When the nomination has been awarded the stallion owner will be so informed and the service ticket issued to the owner of the mare. The sub-committee in charge of the selected stallion should at the same time be informed by the Secretary of the County Committee. Not later than August 10th of any year, particulars (Form H^{17}) as to the distribution of such service tickets should be forwarded to the Board. This form will be returned in the following June for completion as to foals dropped.

A nomination will be forfeited, and will lapse under certain conditions, which are fully set out in the Rules (Form H^{32}).

The Secretary will also be asked to cancel and return to the Board the numbered tickets for any lapsed nominations, in order that he may issue to owners of mares, strictly in the order in which they appear on the reserve list, new tickets, to be obtained from the Board, in lieu of such cancelled tickets.

In the event of the owner of either a mare or stallion being detected in any fraudulent practice in connection with the Board's regulations with regard to the granting of free nominations to mares, in addition to any penalty to which he may be liable by law, he may be debarred from obtaining any future benefits under the Board's operations.

In all cases of dispute the final decision rests with the Board of Agriculture and Fisheries.

The Purchase of Brood Mares.—The Board propose, through the agency of the County Committees, to arrange for the purchase annually of some two hundred half-bred active working mares which will form the nucleus of a county stud, which if carefully selected will, it is thought, form an important asset in the development of light horse breeding. It is not intended that the inclusive cost (*i.e.*, cost of purchase, veterinary fees, &c.) shall exceed on an average £50 per mare, and in each case of purchase a receipt for the amount of the purchase will be necessary. Such receipts are to be forwarded to the Board on demand.

Every brood mare so purchased is to be examined beforehand by a veterinary surgeon approved by the County Committee, who is to be asked to certify as to her freedom from hereditary unsoundness or defects, and her general suitability for breeding purposes.

Care will have to be taken to avoid as far as possible purchasing barren mares, and therefore it is desirable that active young mares likely to breed an animal of the weight-carrying hunter class should be selected, and preference given to mares known to be good foal bearers.

Co-operation between County Committees rather than competition should be aimed at, so that each Committee may buy under the most favourable conditions.

In connection with the purchase of these mares, the following characteristics should be kept in view:—

> Feet strong and sound; legs well formed, and well set on; bodies deep and "roomy"; back and quarters strong; neck and shoulders well placed; head well formed, broad between the eyes, which should be full; courage, quality, and true action.

County Committees will be asked to arrange for the distribution of the mares so purchased to farmers and others occupying land in the district, and to take care they are put in the hands only of persons who may be regarded as solvent and suitable custodians. It is not contemplated that the vendor of the mare shall be permitted to become the custodian of the mare when purchased.

These mares are to be mated annually with a stallion selected by the County Committee, and the custodian will be required to pay the service fee up to a limit of 40*s.*, excluding the groom's fee. It is intended that as a rule a King's premium or Board's premium stallion shall be used, but in special cases some other registered stallion may be selected.

As regards the resulting progeny it is intended that they shall belong to the custodian with the reservation that the County Committee shall have the first refusal to purchase whilst under four years old. To enable a County Committee to exercise the option of doing so it is intended that the custodian of the mare shall not dispose of the progeny without first giving fourteen days' notice in writing to the Secretary of the County Committee of his intention so to do. Mares put out under this scheme remain the property of the Board and are returnable to the Board or to the County Committee on demand. They should therefore be marked with some distinguishing number by tattooing on the lip or otherwise. They are put out at the custodian's risk for any damage done or injury caused by them. It is not intended that these mares should be used for timber hauling, the hauling of dead weights, or, except with the written permission of the Committee, for *regular* work in the shafts, but only for such work as they may be capable of performing having regard to the foal and period of foaling.

Where the County Committee and the custodian cannot agree in respect of any question, it is to be referred to the Board, whose decision shall be final.

The County Committee will be asked generally to supervise the arrangements of mares put out under this scheme and to secure that the rules and regulations (Form H^{22}) are carefully observed. These rules will provide *inter alia* that each mare must be produced if required once in every six months for inspection.

Registration of Stallions.—The owner of a stallion—either light or heavy breed—which is entered in the stud book of its particular breed will be entitled, if he so wishes, to submit his horse annually for examination by a veterinary surgeon approved by the Board as regards soundness for breeding purposes.

A stallion will not be eligible for registration unless the Board are satisfied that it is free from hereditary unsoundness and defects and is otherwise fit for breeding purposes. A veterinary certificate of soundness for breeding purposes will be an essential preliminary to registration, but the Board reserve the right to withhold registration for any other reason which appears to them sufficient.

It is hoped by this means that the use of sound horses throughout the country will be encouraged and that owners of mares will obtain the services of horses holding the Board's certificate of soundness in preference to those of unregistered horses.

The issue of registration certificates free of cost to the owner of the stallion will be limited to cases where the stallion stands at a fee not exceeding £10 exclusive of the groom's fee. Stallions standing at higher fees will also be eligible for registration where the owner is prepared to defray the cost of the veterinary inspection and examination.

The Board are anxious that as many stallions as possible should be submitted for registration, and they hope that members of County Committees will use their best endeavours and influence towards furthering this part of the Board's scheme.

The various Rules made in connection with the Board's scheme, referred to above, will be printed separately, and copies will be forwarded in due course by the Board to County Committees for their information.

Exhibition of Stallions at the Royal Agricultural Hall.

The Board of Agriculture and Fisheries are now prepared to receive applications from owners of Throughbred Stallions to exhibit their stallions at the show to be held by the Board at the Royal Agricultural Hall, Islington, in conjunction with the Hunters' Improvement ment Society, on March 7th, 8th, and 9th next.

Full particulars of the conditions of award of the King's Champion Cup and King's Premium are contained in the premium sheet, copies of which can be obtained on application to the Secretary, Board of Agriculture and Fisheries, 4 Whitehall Place, London, S.W.

Memorandum on the Principles of Rural Education.

The Board of Education have recently issued a "Memorandum on the Principles and Methods of Rural Education,"* which provides a comprehensive survey of that part of the field of agricultural education for which the Board of Education is responsible. The memorandum is intended to call the attention of County Education Authorities to the importance of a well-conceived scheme of rural education in its bearings upon agriculture, and through agriculture upon the general conditions of rural life.

The Board of Education express the hope that this memorandum will serve to illustrate and enforce the need for a comprehensive rather than a piecemeal treatment of the problem of rural education. It is pointed out that if efficient work is to be done, it must be planned not for this or that parish, but for each county as a whole; not for this or that season, but for the years to come, in order that each new generation of students may have the advantage of well-thought-out methods and of an organisation the various parts of which, from the elementary school to the agricultural college, form a coherent whole. For certain purposes, such as the preparation of qualified teachers or the application of research to the problems which bear upon practical agriculture, even the county cannot properly be treated as a self-contained unit; and on such points, as well as on many general questions of principle and organisation, the co-operation of agriculturists and educationalists in the production of a workable scheme for the country as a whole is needed, in order to secure the most satisfactory results.

Welsh Translation of the Board's Leaflets.

In order to make the information contained in several of their leaflets available to agriculturists in parts of Wales where English is not well understood, the Board have issued the following in Welsh:—Farmers and Local Rates (No. 8), Farmers and Income Tax (No. 26), Anthrax (No. 28), Swine Fever (No. 29), Sheep Scab (No. 61), Winter Washing of Fruit Trees (No. 70), Purchase of Artificial Manures (No. 72), Purchase of Feeding Stuffs (No. 74), Preservation of Eggs (No. 83), Fluke or Liver Rot in Sheep (No. 89), Ringworm in Cattle (No. 95), Farmers' Co-operative Societies (No. 97), Wart Disease of Potatoes (No. 105), Feeding of Poultry

* Copies can be purchased either directly or through any bookseller from Messrs. Wyman and Sons, Fetter Lane, London, E.C. Price 3*d.*, postage extra.

(No. 114), The Construction of Pigsties (No. 121), Sheep Dipping (No. 145), Tests for Farmers' Milk (No. 146), Foot Rot of Sheep (No. 154).

Copies of these leaflets for distribution among the Welsh-speaking community may be obtained on application to the Secretary, Board of Agriculture and Fisheries, 4 Whitehall Place, S.W. It is proposed to issue translations of some other leaflets as opportunity offers.

A notice as to the type of horses required for Army Remounts has also been translated into Welsh, by desire of the Army Council, and copies may be obtained as above.

Regulations as to the Growth of Tobacco.

The Commissioners of Customs and Excise have made regulations, to come into force on March 1st, 1911, in relation to the growth and cultivation of tobacco in the United Kingdom, and for securing and collecting the Excise duties payable on tobacco so grown, and also in relation to the curing and removal of any such tobacco, and for enabling licensed manufacturers of tobacco to receive tobacco grown in the United Kingdom.

The Regulations provide that a person may not sow the seed of the tobacco plant or grow tobacco in the United Kingdom or cure tobacco grown in the United Kingdom without having in force an Excise licence for the purpose, and except upon land and premises which have been approved by the Commissioners and have been duly entered by that person.

The Commissioners may refuse to grant a licence for any land or premises on or in which from their situation with respect to the premises of a manufacturer of tobacco, they think it inexpedient to allow the growing or curing of tobacco.

A person requiring a licence shall obtain from the proper Officer a form of application and shall furnish in the form the particulars thereby required, and shall return the form duly filled up and signed by him to the Officer.

The Regulations go on to prescribe the steps to be taken by the grower as to the growing, curing, and removal of tobacco, and in regard to other matters.

The Regulations do not prevent or hinder any person from sowing the seed of the tobacco plant, or supplying or planting tobacco plants solely for botanical, scientific, or ornamental purposes, in any nursery or private garden so long as the area of the land sown or planted does not exceed one pole in any one place or garden.

IMPORTATION REGULATIONS.

Importation of Cattle into the Panama Republic.—A law has recently been passed in the Panama Republic (No. 16 of 1910) which regulates the importation of cattle into the Republic from January 1st, 1911. Heifers of two years of age and under may be imported free of duty and consular fees for the purposes of breeding, but they must not be sold for consumption until the expiration of five years from the date of their importation. Male animals may be imported for fattening upon payment of 7·50 Balboas (Balboa=4*s.* 2*d.*), but must not be sold for consumption until one year after importation. Cattle of every

description may, however, be imported into the province of Bocas del Toro upon payment of 5 Balboas per head on fat stock for consumption, and free of duty in the case of stock for breeding. Importers of cattle into Panama must obtain a permit from the Secretary of Finance. The Consul of the Republic at the port of embarkation will require the shippers to furnish the certificate of a veterinary surgeon declaring that the animals are not affected with any disease.

Importation of Sheep-Dogs into the United States.—An order of the United States Department of Agriculture of November 25th, 1910 (Bureau of Animal Industry, Order 176), provides for the detention in quarantine, for a period not exceeding two weeks, and inspection of all collies, shepherd-, and sheep-dogs imported into the United States from any country of the world except North America. It has been established that these dogs are subject to the infection of tapeworm, causing gid, sturdy, or staggers in sheep, and inspection is conducted with a view to prevent the introduction of the disease in this way. Dogs found to be infected will be detained in quarantine until free from infection.

Importation of Meat into Switzerland.—An Ordinance of the Swiss Federal Council of January 29th, 1909, provides that meat and meat preparations derived from cattle, sheep, goats, or pigs, shall not be imported into Switzerland unless accompanied by a certificate attested by the veterinary inspector of the place of origin, to the effect that such meat and meat preparations are fit for consumption, and that the animals from which they were prepared were found to be free from contagious and infectious diseases, both before and after slaughter. In addition, the meat will be subjected to veterinary inspection on entry into the country. Except in certain cases, the importation of fresh meat is only permitted in the form of entire animals, and in the case of meat preparations, the Ordinance prescribes the kinds of preparations authorised.

The Local Government Board have issued a memorandum of the conditions to be observed in connection with such official certification in the case of meat exported from the United Kingdom, setting forth the requirements to be fulfilled by persons manufacturing meat products, and the conditions to be observed by authorised veterinary inspectors in drawing up the certificate as to freedom from disease.

MISCELLANEOUS NOTES.

Agricultural Machinery in Poland.—H.M. Consul at Warsaw (Mr. C. Clive Bayley) reports that a firm at that place desire to obtain the representation of British manufacturers of agricultural machinery, and especially chaff cutters, threshing machines, and portable engines, and steam straw presses.

Demand for Agricultural Machinery.

The name and address of the firm may be obtained by British makers on application to the Commercial Intelligence Branch of the Board of Trade, 73 Basinghall Street, London, E.C. Any further communications regarding the inquiry should be addressed to the British Consulate, Warsaw. (*Board of Trade Journal,* January 5th, 1911.)

Agricultural Machinery in Bulgaria.—H.M. Legation at Sofia state that, according to reports from the interior of Bulgaria, the quality of

British agricultural machinery is much appreciated by the peasantry, and sales would be largely increased if firms were represented on the spot by competent agents, who would be in a position to sell the machines cheaper than is done at present by the retail dealers, and who could offer expert advice as to their management. The question of credit is particularly important in this branch of trade, and an agent would be able to extend easy terms to suitable clients. (*Board of Trade Journal*, January 5th, 1911.)

Meat Refrigerating Machinery in Paraguay.—A law of September 30th, 1910, provides that machinery, &c., destined for the installation of meat-refrigerating establishments in Paraguay may be imported duty free, if such establishments are founded with the exclusive object of exporting their products. (*Board of Trade Journal*, January 12th, 1911.)

Notes on Agriculture Abroad.

Cultivation of Potatoes in Russia for Use in Distillation of Alcohol.—H.M. Consul-General at Odessa (Mr. C. S. Smith) reports that the use of potatoes in the distilling of alcohol in Russia becomes annually more important, great quantities being grown especially for this purpose. In 1910 the crop for the whole of European Russia obtained from these plantations greatly exceeded that of the previous year. The quality in most parts was better than in 1909; the proportion of starch varied from 11 per cent. to just over 22 per cent. The climate of Russia is generally thought to be favourable for the production of good potatoes in vast quantities, and it is suggested that this branch of agriculture might be largely developed by the use of artificial fertilisers. (*Board of Trade Journal*, January 12th, 1911.)

Export of Bacon from Russia to Great Britain.—A report of the United States Consul-General at Moscow states that English capitalists are building slaughterhouses in Russia for the butchery of hogs for the English market. The capacity of such an abattoir at Radovetz, Lublin Province, will be 3,000 hogs per week. English capital is also to be employed in the erection of refrigerating apparatus in connection with the bacon and other industries. (*U.S. Daily Consular and Trade Reports*, Dec. 10th, 1910.)

The Engelmann Spruce.

Forest Service Circular No. 170 of the U.S. Department of Agriculture gives an account of the Engelmann Spruce in the Rocky Mountains. It is possible that from its wind-firm, frost-hardy, and moisture-loving characteristics this species might be of considerable use in exposed localities in Britain, and the following summary of the circular is given :—

Distribution.—The Engelmann spruce is to be found from the Yukon Territory south through British Columbia, Oregon, and throughout the Rocky Mountains to Arizona and New Mexico. It attains its largest size and greatest density of stocking in Alberta and British Columbia. In common with other species of wide latitudinal distribution, Engelmann spruce occupies progressively higher altitudes from its northern

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to its southern limits. Over the greater part of its range, it grows in small bodies, and except in the south, where it is confined to elevated localities, it is found in mixture with other species.

Moisture, Light, and Soil Requirements.—The Engelmann spruce is very dependent for its welfare upon proper moisture conditions of both soil and air. Thus altitude and aspect are important factors, in that they affect the amount of precipitation and its conservation. It is very tolerant of shade. Young trees will endure 30–50 years of suppression, and, when released, will recover rapidly and make good growth. The physical condition of the soil, rather than its composition, is of the first importance, though it is believed that Engelmann spruce yields its greatest volume on limestone soils. Swampy situations are good, unless the soil is sour, but in the seedling stage, growth is sometimes slower in swampy places than on slopes.

Habit, Root System, Growth, and Wood.—The crown of the Engelmann spruce is very heavy, thick and dense, and, except in very close woods, extends well down the stem. Like other trees, Engelmann spruce varies in form with the situation. As a rule, there is considerable taper, except in dense woods in the best situations. The most cylindrical timber is to be found in deep, moist valleys, and on northern slopes (when grown closely). In good situations the average size of the Engelmann spruce varies from 80–100 ft. in height, and from 20–30 in. in diameter, though these dimensions are greatly exceeded in individual trees—especially in Canada.

Though the root system of the Engelmann spruce is superficial, it is so well developed that the tree is wind-firm. As a rule mature trees have several very strong lateral roots with a radius of 20 ft. or more, which do not, however, extend more than 2 ft. below the surface of the ground. This root system, while making the tree dependent upon superficial soil moisture, enables it to thrive on shallow soils.

Engelmann spruce grows rather slowly, except when light conditions are favourable throughout its entire life—which is rarely the case in its native forests, where it often takes 150 years and more to attain a diameter of 18 in.

The wood of this tree is very light in weight, pale yellow in colour, very close, and usually straight grained, even-textured and easily worked. Heartwood and sapwood are so nearly of the same colour that it is difficult to distinguish between them. As a rule, heartwood is not formed until after the age of 70 years. The wood is not durable in contact with the soil, but finds many uses in protected places as construction material. It is also used for pit props, sleepers, posts, and poles of all kinds.

Reproduction.—Engelmann spruce reproduces itself abundantly from seed, provided that the surface of the soil is moist, and not covered with dry leaves and needles to such an extent that the rootlet of the germinating seed cannot reach the moist underlying soil.

Management.—Owing to the nature of the habitat of Engelmann spruce and to the characteristics of the species which grow in mixture with it, the United States Forest Service recommends that forests of this tree should be treated under the selection system, and be regarded as protection forests.

Co-operative Agricultural and Credit Societies in the United Kingdom.

Co-operative Agricultural Societies.—The following note, based upon Returns made direct to the Board of Trade, is summarised from information which appeared in the *Labour Gazette* for January, 1911.

Co-operative agricultural societies are mainly associations of producers, and may be classified into "productive" societies, "distributive" societies, and associations for the insurance of cattle. The "productive" societies are occupied in buying, manufacturing, and selling the produce of the individual members, and their operations are chiefly confined to the dairying industry. There were 317 such societies in the United Kingdom in 1909, their total sales amounting to £2,005,314, and their profit to £23,663.

The "distributive" societies are occupied in the collective purchase and distribution of the seeds, manures, implements, &c., required by the members, and in the sale of the cattle, eggs, poultry, &c., produced by members. There were 336 such societies in 1909, with sales amounting to £1,566,077, and profit to £13,071. The distribution of the profit in the case of both types of society is determined by the value of the transactions carried out for the individual members.

The membership of the above 653 societies was 85,272, with a total share capital of £221,268. Their loan capital amounted to £232,158; reserve and insurance funds to £165,161. In addition to these associations must be reckoned the farming and dairying departments of 71 industrial societies and one agricultural society.

The following table shows the sales of the agricultural productive and distributive societies in 1908 and 1909, as compared with 1899:—

	Production.		Distribution.	Total.
	Special Farming and Dairying Societies.	Farming and Dairying Departments of Wholesale and Retail Distributive Societies.	Agricultural Trading, Egg and Poultry, and Bee Keepers' Societies of all kinds.	Agricultural Distribution and Production by Societies of all classes.
	£	£	£	£
1899	645,158	307,548	333,825	1,286,531
1908	1,929,540	494,889	1,292,503	3,716,932
1909	2,005,314	467,967	1,566,077	4,039,358
Increase of 1909 over 1899	1,360,156	160,419	1,232,252	2,752,827
Percentage increase	210·8	52·2	369·1	214·0

In distribution nearly 66½ per cent. of the total increase shown during the ten years has taken place in England and Wales, 15·1 per cent. in Scotland, and about 18½ per cent. in Ireland. Of the increases in production 84·8 per cent. is attributable to societies in

Ireland, 7·7 per cent. to Scotland, and 7·5 per cent. to England and Wales.

The live stock insurance societies are formed specially for the mutual insurance of the cattle, pigs, &c., belonging to the individual members, who are mainly small holders in England and Wales. The number of such societies making returns was 57 in 1909, or the same as in 1908, but the membership had increased from 3,872 in 1908 to 3,954 in 1909.

Co-operative Credit Societies.—Returns furnished to the Board of Trade by Co-operative Credit Societies show that in 1909 there were 35 such societies at work in England, with a total membership of 3,783, and one, with 353 members, in Scotland. Nineteen of the societies (18 in England and one in Scotland) were in urban districts, the remaining 17 English societies being in agricultural districts.

Census of Production.

Part VI. of the Preliminary Tables summarising the results of the returns received under the Census of Production Act has now been issued (Cd. 5463, price 6*d.*), and contains, among other particulars, information relating to the bacon-curing, butter, cheese, and margarine industries.

Bacon-curing Factories and Workshops.—The following particulars as regards output are based on returns received from factories and workshops engaged in the curing of bacon and hams, and the manufacture of lard, sausages, and kindred products for the wholesale trade. The curing of bacon or hams, or the making of sausages by farmers and others for their own retail trade, has been, as far as possible, excluded from the tables.

—	England and Wales.	Scotland.	Ireland.	England and Wales.	Scotland.	Ireland.
Output.	Quantity.			Value.		
	Cwts.	Cwts.	Cwts.	£	£	£
Bacon	748,000	103,000	865,000	2,423,000	361,000	2,581,000
Hams	215,000	156,000	86,000	803,000	519,000	336,000
Pork, salted, other than bacon and hams ..	10,000	—	8,000	20,000	—	11,000
Lard	463,000	10,000	114,000	1,121,000	26,000	267,000
Sausages	(*Recorded by value only*)			542,000	167,000	42,000
Heads				66,000	2,000	114,000
Sausage casings ...				224,000	44,000	22,000
Preserved meats (including brawn, tinned meats, &c.)				315,000	44,000	24,000
Offals				103,000	9,000	166,000
Other products				99,000	37,000	21,000
Total value of output ...	—	—	—	5,716,000	1,209,000	3,584,000
Cost of materials used ...	—	—	—	5,020,000	1,059,000	3,372,000
Value of output *less* cost of materials used ...	—	—	—	696,000	150,000	212,000

The total value of the above products for the whole of the United Kingdom amounts to £10,509,000.

Butter, Cheese, and Margarine Factories and Workshops.—The following statement of output is based on returns received from factories and workshops engaged in the manufacture of butter, cheese, cream, margarine, and similar products, and in the blending of butter. Butter, cheese, &c., made by farmers are not included, nor the butter, cheese, &c., made by ordinary retail dairies as a subsidiary part of their business, or for the purpose of using up surplus milk and cream. Only establishments manufacturing such products on a commercial scale are referred to.

—	England and Wales.	Scotland.	Ireland.	England and Wales.	Scotland.	Ireland.
Output.	Quantity.			Value.		
	Cwts.	Cwts.	Cwts.	£	£	£
Butter, made or blended	408,000	14,000	670,000	2,206,000	83,000	3,505,000
Cheese	53,000	20,000	2,000	155,000	32,000	6,000
	Imp. galls.	Imp. galls.	Imp. galls.			
Cream, sold	750,000	214,000	134,000	291,000	65,000	42,000
	Cwts.	Cwts.	Cwts.			
Margarine (including all kinds of artificial or imitation butter) ...	745,000	66,000	65,000	1,758,000	169,000	154,000
Other products	(*Recorded by value only*)			1,293,000	30,000	313,000
Total value of output ...	—	—	—	5,703,000	379,000	4,020,000
Cost of materials used ...	—	—	—	4,960,000	312,000	3,663,000
Value of output *less* cost of materials used ...	—	—	—	743,000	67,000	357,000

The total value of the above products for the United Kingdom is £10,102,000.

The *Monthly Agricultural Report*, issued by the Board of Agriculture and Fisheries on February 8th, gives the following general summary of agricultural conditions in Great Britain on February 1st:—

Agricultural Conditions in Great Britain on February 1st.

The Crop Reporters of the Board, in reporting on agricultural conditions on February 1st, generally mention that the weather of January, after the first fortnight, was favourable to the autumn-sown crops. In consequence of this improvement, the appearance of the young wheat was, on the whole, more satisfactory than a month previously. Early-sown wheat nearly everywhere may be said to be looking fairly well, but the later sown crops are mostly a thinner plant. Much of the land which had been flooded in December will have to be re-ploughed, and the appearance of the surviving crops is poor. At the end of the month there was some frost, particularly in the east and midlands, which was of advantage to the heavy lands, but Scotland appears to have had unusually mild weather. The general open weather allowed of fair progress in preparing the land for the spring corn; and in the south-west a certain

amount of arrears, which had accumulated during December, are said to have been worked off. Considerable areas south of the Trent were sown with wheat during the latter half of the month.

The drier weather has also suited ewes, which are for the most part in better condition than a month ago. Although the lambing season, in the few counties where it had commenced by January 1st, had not opened very auspiciously, reports are now more favourable, but still rather variable. Perhaps the earliest districts have fared worst: reports of a certain amount of abortion and of an unusual number of deaths among ewes in parts of Dorset, Hants and Wilts have been received, and from the Home Counties north of London reports are not too satisfactory. Otherwise the fall of lambs seems about average (though heavy losses among them are reported in Hampshire), more twins than usual in some districts being counterbalanced by a smaller number in others. In the northern districts, where lambing has not yet commenced, no apprehension seems to be entertained as to the prospects, as the ewes are generally thriving.

Cattle are generally reported to be doing well, except in some districts, where it is thought that their poorness of condition is attributable to the indifferent quality of the hay and roots. In the north it has been found possible to keep stock out at pasture more than usual, and thus to economise the turnips.

Notes on the Weather in January.

The weather during the *first* week (January 1st to January 7th) was generally fair to fine at the beginning, but the conditions deteriorated towards the end of the week. Warmth was "moderate" except in England S.W., where the deficiency was 2° below the normal. Rainfall was heavy in England N.E. and E., and moderate elsewhere, although heavy falls were experienced towards the close of the week in the western and north-western districts. Bright sunshine was above the average in Scotland and the western districts of England, and about equal to it or rather less in the eastern, central, and south-eastern districts.

The general character of the *second* week was unsettled, rain being experienced in most localities, with sleet or snow at the end of the week. Temperature was "moderate" over the country, and only in the three easterly districts of England N.E., E., and S.E., was the rainfall "heavy." The amount of bright sunshine recorded exceeded the average in all districts except Scotland N.

During the *third* week the weather was generally dry, although there was a considerable amount of cloud in most parts of England, with rather frequent mist or fog. Temperature varied, but was generally "moderate." Rainfall was less than the average in all districts, being "light" in England E. and S.E. and Scotland N., and "very light" elsewhere. Bright sunshine was not very uniform, a "scanty" amount being reported from England S.E. and Scotland W., and a "very abundant" amount from Scotland E.

On several occasions in the *fourth* week rain fell in Scotland and in the south-west of England, but the quantity was generally very slight; only in Scotland N. and W. was it even "moderate." In other parts of Great Britain the weather, although often very cloudy and in many

places foggy, was mostly dry and occasionally fine and bright. Temperature was everywhere above the average, the excess amounting to about 4° in some of the northern and north-western districts. Bright sunshine was below the average except in England S.E.

Notes on Crop Prospects Abroad.

The International Agricultural Institute, Rome, has received official estimates of the production of cereals from four countries of the Southern Hemisphere, viz., Argentina, Chile, Australia, and New Zealand. With regard to wheat, although the total area to be harvested in these four countries is 2 per cent. less than the area harvested in 1909–10, the total production promises to be 7·8 per cent. greater. The figures relating to the individual countries are as follows:—

	Wheat.				Barley.			
	Area.		Production.		Area.		Production.	
	1910–11.	Compared with 1909-10.	1910–11.	Compared with 1909-10.	1910–11	Compared with 1909-10.	1910–11.	Compared with 1909-10.
	Acres.	%	Cwt.	%	Acres.	%	Cwt.	%
Argentina ...	12,234,000	84·9	73,008,000	104·1	—	—	—	—
Chile	2,258,000	191·5	19,337,000	182·9	133,000	—	884,000	—
Australia ...	7,304,000	111·0	48,059,000	99·0	—	—	—	—
New Zealand...	280,000	80·0	3,749,000	85·0	34,000	100	455,000	100

	Oats.				Maize.			
	Area.		Production.		Area.		Production.	
	1910–11.	Compared with 1909-10.	1910–11.	Compared with 1909-10.	1910–11.	Compared with 1909-10.	1910–11.	Compared with 1909-10.
	Acres.	%	Cwt.	%	Acres.	%	Cwt.	%
Argentina ...	1,606,000	128	11,610,000	110	7,942,000	—	—	—
Chile	111,000	—	693,000	—	67,000	—	939,000	—
New Zealand...	356,000	70	2,785,000	60	9,000	100	315,000	101

West Australia.—The Imperial Trade Correspondent at Perth (Mr. J. F. Conigrave) reports that recent official estimates forecast an increase of 170,792 acres in the area under wheat cultivation during the season 1910–11, the area in 1909–10 being 448,918 acres. The aggregate yield this season is estimated at 7,594,264 bushels, or an average yield of 12·3 bushels per acre, as compared with a total yield of 5,602,368 bushels, or 12·48 bushels per acre in 1909–10. The area under the cultivation of oats, which was 73,342 acres in 1909–10, is expected to decrease by 4,077 acres, and the yield, which was 1,248,162 bushels in 1909–10, to decrease by 126,297 bushels. (*Board of Trade Journal*, January 5th, 1911.)

Argentina.—A dispatch dated December 29th, 1910, forwarded by H.M. Minister at Buenos Aires, states that the prospects of the wheat

and linseed harvests which had begun in the north of the Republic, were normal, although hailstorms had done some damage.

The Ministry of Agriculture has estimated the area under maize at 7,941,000 acres, as compared with 7,422,000 acres in 1909–10. The largest increase is one of 39·2 per cent. in the Province of Cordoba; Santa Fé also shows an increase of 10 per cent., while Buenos Aires shows a slight decrease, which must be principally attributed to the drought in the south. In the event of further rains there was every prospect of a good maize crop.

A later despatch, dated January 4th, states that it is generally agreed that the linseed and oats crops have failed, whilst opinions are divided about the wheat crop, which will probably prove rather better than last year. Much anxiety is expressed about the maize crop, and the drought is being seriously felt on the grass lands. Large numbers of cattle have died, and so have increased the shortage in the supply.

Wheat in India.—The First General Memorandum on the wheat crop issued at the end of December states that the area sown with wheat, in the districts from which returns had been received, was 23,431,000 acres, as compared with 22,664,000 acres in the previous year, or an increase of 3·3 per cent. This is stated to be about 85 per cent. of the total area under wheat. The condition of the crop was reported to be generally good. (*Indian Trade Journal,* December 29th, 1910.)

Canada.—The Census and Statistics Office of Canada, in the *Census and Statistics Monthly* for December, 1910, gives the area and yield of the principal crops as follows:—

	Wheat.		Oats.		Barley.	
	Area.	Yield.	Area.	Yield.	Area.	Yield.
	Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.
1910	9,291,800	149,989,600	9,864.100	323,449,000	1,834,000	45,147,600
1909	7,750,400	166,744,000	9,302,600	353,466,000	1,864,900	55,398,000
1908	6,610,300	112,434,000	7,941,100	250,377,000	1,745,700	46,762,000

The Board of Agriculture and Fisheries have been furnished by the Board of Trade with the following report, based on returns from correspondents in various districts, on the demand for agricultural labour in January:—

Agricultural Labour in England during January.

Employment was generally regular, except for a few days in the early part of the month, when some men who were not attached to the staffs of farms lost time on account of rain. It was somewhat difficult, however, for these extra men always to obtain employment in a large number of districts on account of the slack season of the year, and an excessive supply of men was reported in many instances. What demand there was for these men chiefly arose from such work as threshing, hedging, ditching, and carting and spreading manure. Some scarcity

of men for permanent situations was reported from certain parts of the Midland and South-Western Counties.

Northern Counties.—January is usually a slack month in these counties, and in many districts, particularly in the more northern counties, there was little employment for men outside the regular farm staff. Extra labourers were, however, in some demand in parts of *Lancashire* and *Yorkshire*, and a number of such men obtained fairly regular employment at carting and spreading manure, hedging, ditching, and threshing. The demand was fully equalled by the supply in most districts, and in the East Riding of *Yorkshire* a surplus of labour was generally reported.

Midland Counties.—Day labourers lost a little time in the early part of the month in some districts on account of rain, but their employment generally became more regular as the month advanced and the weather became finer. At no time, however, was there much demand for extra labour, and in most counties the supply was said to be above the demand in certain districts reported on. Extra men were chiefly employed at threshing, hedging and ditching, and with the manure carts.

Eastern Counties.—Employment in these counties was fairly regular on the whole, though here also day labourers lost a little time at the beginning of the month. In some districts there was a very fair demand for such men on account of threshing, hedging, ditching, draining, and manure-carting. In others there was only a moderate demand, and a surplus of labour was reported, particularly in the Newmarket, North Witchford, and Ely rural districts of Cambridgeshire, and the Bourne (Lincolnshire), and Henstead (Norfolk) rural districts.

Southern and South-Western Counties.—There was generally very little interruption to farm work in these counties, and day labourers were usually in fairly regular employment. There was, however, but little request for extra men in many districts, it being the slack season of the year, and, generally speaking, the only counties in which the demand was more than moderate were Somerset, Devon, and Cornwall, where it was described as fair. The demand was chiefly for threshing, hedging, ditching, manure-carting, and root-cleaning. An excess of extra men was reported in the West Ashford (Kent), West Lampnett (Sussex), Havant (Hampshire), Devizes (Wiltshire), Wareham and Purbeck (Dorset), and Hereford rural districts. Some scarcity of men for permanent situations was reported in the Williton (Somerset), Axminster and Newton Abbot (Devon), and the Camelford, Truro and West Penwith (Cornwall) rural districts.

THE CORN MARKETS IN JANUARY.

C. KAINS-JACKSON.

Wheat.—The leading cereal still averages just over thirty shillings per statute quarter, which means 31*s.* 6*d.* at Mark Lane and other markets adhering to the East of England standard of 504 lb. The increasing sale of poultry wheat at the markets has some little effect in lowering the average. Poultry wheat has, in fact, been selling well at 27*s.* to 28*s.* per 448 lb., a price much nearer to that of milling wheat than the ordinary observer notes, the latter being quoted per 480 to 504 lb. The first month of 1911 has passed without any really material change in British, Indian, or Australian wheat, but fine Canadian is 1*s.* dearer and average La Plata 1*s.* cheaper to buy. The Canadian is scarce on spot, but Argentine is coming forward in increased quantity weekly. The month's shipments were 378,000 qrs. from North America, 644,000 qrs. from South America, 457,000 qrs. from India, 726,000 qrs. from Australia, 1,237,000 qrs. from Russia, and 937,000 qrs. from Europe S.E. The Australian exports argued a good demand for the new crop. The supply on passage, of all sorts, has increased from 1,995,000 qrs. to 2,100,000 qrs. on the month, but is still moderate. There is more Argentine and Australian coming, from the end of 1910, less Russian, American, and Canadian. Prices ruling as the month closed were 30*s.* to 35*s.* per 504 lb. for English wheat, 36*s.* to 39*s.* for Canadian, 35*s.* 6*d.* to 38*s.* for American, 35*s.* to 36*s.* for Argentine, 37*s.* to 38*s.* for Australian, and 30*s.* to 36*s.* for Russian. There is little Roumanian on offer in England; where met with it shows somewhat over average quality.

Flour.—Stocks of imported descriptions are smaller than usual, and the market for Canadian, Minnesota, Californian, and even Kansas has become very firm. Hungarian is the only foreign sort which is in freer offer from last year. It is cheap as things go, and is much appreciated by confectioners. Australian is steady on spot, but decidedly weaker for shipment. London makes are quite unchanged, 32*s.* to 32*s.* 6*d.* for best, 30*s.* to 30*s.* 6*d.* for fine white, and 27*s.* to 27*s.* 6*d.* for household. Whole meal gains in demand, so that 27*s.* 6*d.* is paid for best and 26*s.* 6*d.* for secondary. The demand for country flour has been disappointing. All-English at 25*s.* gives a clue to value, but the chief business appears to be done in consignments sent up with a proportion of stronger foreign wheat or wheat-flour already added. A half-and-half mixture representing possibly 50 per cent. East Anglian, 25 per cent. Manitoba, and 25 per cent. Indian, fetches 26*s.* per sack or thereabouts. The large London mills now import strong wheat from the American North-West, grind it in London, and sell it with a guarantee of purity. The demand for such flour is considerable, and enables "the manufacturing profit" to be retained in London. American flour shipments for January were only 344,000 sacks, and the quantity on passage has fallen to 160,000 sacks of all foreign sources.

Barley.—The average price of British barley for the week ending January 28th was the same as for the twenty-two completed weeks of the season. This augurs a remarkable stability, though, unfortunately, at a level unremunerative to growers of an average crop. The yield of 1910 not exceeding an average, a depressed feeling is manifest, and

it was not expected that 1911 sowings would attain a usual figure. Californian barley is coming to the aid of brewers, and substantial arrivals are anticipated. About 30*s.* is suggested for f.a.q., with 32*s.* for a better grade, and 35*s.* for fine malting. Russian feeding barley has advanced about a shilling. Shipments for January were 105,000 qrs. from North America, 915,000 qrs. from Russia, and 242,000 qrs. from Europe S.E. The quantity on passage on 31st was 690,000 qrs.

Oats.—The last few days of January witnessed a marked inquiry for seed oats, for the period 1st–28th had been of a drying character on the whole, and it was now possible to get on the land. Prices for the select seed types seldom exceeded a guinea on the markets, but seedsmen with named and noted sorts to sell, or with new varieties to offer, asked two, and even three, guineas per quarter. The average for British oats for the twenty-two completed weeks of the season stood, with closing January, at 16*s.* 7*d.* per qr. Russian and Argentine oats have remained cheap, and the latter are being shipped so freely that low prices seem likely to rule for some time to come. January shipments were 560,000 qrs. from South America, 713,000 qrs. from Russia, and 30,000 qrs. from Europe S.E. The quantity on passage on 31st was 600,000 qrs., a decidedly over-average total.

Maize.—The United States in January sent off 920,000 qr. of new crop, a quantity not up to expectation, though in itself a full average. The maize crop secured in October was generally accepted as being 44,000,000 qrs. above that of the previous year, and the official estimates from Washington and Rome upheld market ideas of a bumper yield. If January exports could be accepted as a criterion, America in 1911 will ship at a good rate, but still nothing extraordinary. Other January shipments were 449,000 qrs. from South America, 266,000 qrs. from Russia, and 218,000 qrs. from Europe S.E. There were 700,000 qrs. on passage at the end of the month, and the market was more confident from the close of December. A guinea per qr. commanded American, 22*s.* Russian, 22*s.* 6*d.* Roumanian, and 23*s.* to 23*s.* 6*d.* La Plata.

Oilseeds.—The dearness of linseed continued, though the quantity on passage has increased from 34,000 to 82,000 qrs. Argentina has shipped 326,000 qrs. of her new crop, but America has been a buyer in competition with England and Europe, so that the stringency of the Old World markets has not been relieved. India shipped no linseed, and the new crop will not begin to be secured until the middle of March. Present prices are 75*s.* per 424 lb. for best English, 73*s.* per 424 lb. for Russian, 71*s.* per 416 lb. for Argentine. The new Indian crop is offered for April shipment at 68*s.* per 410 lb. Egyptian cottonseed at 8*s.* 6*d.* per cwt. is 3*d.* dearer on the month, even to large wholesale buyers, and up to ten shillings per cwt. is charged locally for smaller quantities than a ton.

Various.—Dear oilseeds are sending many buyers to the market for soy beans, of which a fair quantity is on passage. The price is 8*s.* 6*d.* to 9*s.* per cwt., however, a great change from the 7*s.* at which they were to be had until quite recent dates. Feeding rice is 2*d.* per cwt. dearer on the month, 7*s.* 8*d.* against 7*s.* 6*d.*, and beet sugar is also 2*d.* dearer, 9*s.* 2*d.* against 9*s.* per cwt. Canary seed has advanced half a crown per qr., while dari, millet and small pulse remain unchanged.

THE LIVE AND DEAD MEAT TRADE IN JANUARY.

A. T. MATTHEWS.

Fat Cattle.—The average prices of fat cattle in the English markets in January continued to show a downward tendency, but this statement may, to some extent, be discounted by allowing something for the special figures realised for Christmas beef in December. Markets in January did, in fact, exhibit remarkable steadiness throughout at the lower levels reached. For instance, first quality Shorthorns never varied as much as a farthing per stone in their weekly average, which came out every time at 8*s.* per 14 lb. stone. The averages for this breed were, first quality, 8*s.* against 8*s.* 1*d.* in December; second quality, 7*s.* 3½*d.* against 7*s.* 3¾*d.*, and third, 6*s.* 4*d.* against 6*s.* 5*d.* Herefords averaged 8*s.* 2¼*d.* and 7*s.* 6*d.* against 8*s.* 2½*d.* and 7*s.* 6¾*d.*, and Devons, 8*s.* 3*d.* and 7*s.* 7*d.* against 8*s.* 3½*d.* and 7*s.* 7*d.* The average for Welsh Runts was 7*s.* 10¾*d.* and 7*s.* 4¼*d.*, and for Polled Scots 8*s.* 2¼*d.* and 7*s.* 9*d.* per stone.

The quotations for Shorthorns at the Metropolitan Market have been relatively high owing to the excellent supplies of "Norfolks," as the Irish-bred Shorthorns are there called, and the high reputation they enjoy with London buyers for weighing well after slaughter. In the second week their top quotation was 8*s.* 9*d.*, the highest recorded in any English market, and in no week did the best of them fetch less than 8*s.* 5*d.*, while ordinary Shorthorns, classed as first quality, were only making 7*s.* 7*d.* in some important country markets. This is a striking commentary on the results of good feeding.

Veal Calves.—Calves of good quality were rather scarce and fetched high prices in some of the northern markets, the extreme being 10*d.* and 9¾*d.* per lb. The average in about twenty British markets was 8¾*d.* for prime quality and 7½*d.* for second.

Fat Sheep.—There was a distinct and very satisfactory improvement in the sheep trade, amounting to about ¼*d.* per lb. over the rates of December. In the English markets Downs averaged 8½*d.*, 7½*d.*, and 6*d.* per lb., and Longwools 8*d.*, 7*d.*, and 5½*d.*, and these figures have not been exceeded in any monthly average since April last. In the week ending January 26th, six English markets quoted "Downs" at 9*d.* per lb., and one (Salford) at 9¼*d.*, while at Norwich and Hereford the top price was 8*d.* This shows a very wide difference for sheep classed as Downs, but as I have before remarked, the term is an elastic one, and is applied to breeds which vary in value to the extent of fully ½*d.* per lb. For instance, the London quotation in that week was 8½*d.*, but had there been choice Southdowns on offer there is not the slightest doubt they would have easily realised 9*d.* per lb. It is evident that the turnip crop is holding out well, and there is a much better demand for store sheep. In the last week fat lambs were quoted in three markets, viz., Dorchester at 11*d.* and at Leeds and Wakefield at 1*s.* 3*d.* per lb.

Fat Pigs.—The fall in bacon pigs which became so pronounced in December was continued in January. The average in about thirty British markets was 7*s.* 2½*d.* and 6*s.* 7*d.* per 14 lb., denoting a further decline of 1½*d.* on first and 2*d.* on second quality.

Carcass Beef—British.—In Smithfield Central Market Scotch beef has been rather largely supplied, and there was a decline in prices somewhat out of proportion to the fluctuation in inferior qualities. Short sides averaged $6\frac{7}{8}d.$ for first and $6\frac{5}{8}d.$ for second quality, and long sides $6\frac{1}{4}d.$ and $6d.$ per lb., representing a slight fall from December prices. There was some moderately good English beef on offer, and this averaged $5\frac{7}{8}d.$ and $5\frac{5}{8}d.$ per lb.

Port-Killed Beef.—The trade in Deptford-killed beef in London is gradually losing importance, and has scarcely any effect on the value of other descriptions. The average price at Smithfield in January was $5\frac{3}{4}d.$ and $5\frac{1}{4}d.$ for first and second qualities.

Chilled Beef.—United States chilled averaged $6\frac{1}{8}d.$ per lb. for best hindquarters and $4\frac{1}{8}d.$ for best forequarters. Argentine hinds of best quality averaged $4\frac{1}{2}d.$ and best fores $3\frac{1}{4}d.$ per lb. Arrivals were moderate and prices fairly steady.

Frozen Beef.—Trade in frozen beef was without special feature, except that forequarters sold at higher prices than usual in proportion to hindquarters. The price of the best hinds was $3\frac{1}{2}d.$ and of the best fores $3d.$ per lb.

Carcass Mutton—Fresh Killed.—The value of fresh-killed mutton advanced in sympathy with the improved trade in live sheep. In the third week consignments of small Scotch tegs of about 40 lb. to Smithfield were stated to be the largest on record. These averaged $7\frac{5}{8}d.$, and larger sheep $7d.$ per lb. English mutton averaged $6\frac{3}{4}d.$ for best quality. At the close of the month the cessation of the Dutch supplies gave an additional impetus to the demand for home-killed mutton.

Frozen Mutton.—The arrivals of New Zealand mutton were extremely small, and the best averaged $4\frac{5}{8}d.$ per lb. There were, however, ample supplies from Argentina and Australia, which realised $3d.$ to $3\frac{1}{2}d.$ as the average price.

Carcass Lamb.—There was a steady demand for frozen lamb, and prices of the best New Zealand continued high, averaging $6\frac{1}{4}d.$ and $5\frac{1}{2}d.$ per lb. for first and second quality. Australian and Argentine lamb fetched about $1d.$ per lb. less than the above.

Veal.—Prime English veal was scarce in London, and averaged from $7d.$ to $8d.$ per lb., according to quality. A few small Dutch realised fancy prices, but the current value was much the same as that of English.

Pork.—The supplies of pork were rather large and fully equal to the demand. Prices ruled lower than in December though there was no serious fall. English carcasses averaged $7\frac{1}{4}d.$ and $6\frac{3}{4}d.$ per lb. for the month, and Dutch $6\frac{3}{4}d.$ and $6d.$ for first and second quality.

THE PROVISION TRADE IN JANUARY.

HEDLEY STEVENS.

Bacon.—The year opened with higher prices than were expected, and by the middle of the month further advances had been secured, which again had the effect of diminishing consumption, resulting in a fall in prices all round on account of some accumulation of stock. Before the month closed all the advance had been lost, and long sides were

2*s*. to 4*s*. cheaper than at the beginning of the year. The arrivals from Russia were smaller, and in consequence this description of bacon showed proportionately a smaller reduction in price.

The arrivals from America were more than sufficient for all requirements, and prices were generally reduced to stimulate consumption, but buyers were shy of operating, and the outlook is for still lower prices on spot, although the cost of production is several shillings more. American hogs continue to be marketed in very small quantities, and in consequence packers cannot force prices down to the level anticipated. Prices ranged from $7.60 to $8.25, against $8.00 to $8.90 at the same time last year, and $5.25 to $6.75 two years back.

Canada continues her small shipments, as, with the continued high prices for hogs, the business is not remunerative to the Canadian packers. Pigs are being marketed more freely in our own country, and prices are slightly easier.

Cheese.—The month opened with a quiet demand, but later there was a much better trade, and prices hardened to the extent of 1*s*.–2*s*. per cwt., with holders doing their best to lift values still further. However, buyers have held off, anticipating the arrivals of New Zealands, and spot stocks of Canadian being larger than for four years past, it is not likely that any serious advance in prices will take place. The shipments from New Zealand from the opening of the season to the middle of January were about 10 per cent. less than for the same period last year, but it is anticipated that this shrinkage will be made up as the season progresses. Prices are a little higher than at the same time last year. Canadian cables ask 59*s*.–60*s*. c.i.f. for best stored lots. In the United States of America best stored lots are being held for equal to 74*s*. c.i.f.

English cheese moved fairly into consumption, with prices about 2*s*. per cwt. above those current at the same time last year.

The stocks of Canadian cheese at the three principal distributing centres (London, Liverpool, and Bristol) at the end of the month were 266,000 boxes, against 245,000 at the same time last year, and 261,000 two years ago.

Butter.—Prices during the month have shown considerable variation as a result of manipulation on the part of the large London operators. Nearly the whole of the Australian and New Zealand outputs is this year being consigned, and with the large shipments arriving and on passage there is no reason why prices should be advanced; the smaller dealers are therefore acting cautiously. At the end of the month prices were around 12*s*.–14*s*. per cwt. below those prevailing at the same time last year, say 98*s*.–106*s*. The increase in imports from Australia, New Zealand, and Canada into the United Kingdom from June, 1910, to the end of January, 1911, is 4,500 tons over the quantity for the same period of 1909 and 1910.

In the United States best Creameries made prices equal to 124*s*.–130*s*. c.i.f., but there are large quantities of the summer make in American cold stores, some of which it will be necessary to export to this country.

Eggs.—There has been a very good demand throughout the month for pickled sorts, on account of the scarcity of new laid, which was more pronounced towards the end of the month.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and SCOTLAND in the Month of January, 1911.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	England.		Scotland.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK :—	per stone.*	per stone.*	per cwt.†	per cwt.†
Cattle :—	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Polled Scots	8 2	7 8	39 3	36 0
Herefords	8 2	7 5	—	—
Shorthorns	8 0	7 3	38 2	35 3
Devons	8 3	7 7	—	—
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	*d.*	*d.*	*d.*
Veal Calves	8¾	7¾	9	6¾
Sheep :—				
Downs	8½	7½	—	—
Longwools	8	7	—	—
Cheviots	8¾	7¾	8¾	7¼
Blackfaced	8½	7¼	8	6½
Cross-breds	8½	7¾	8¾	7¾
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs :—	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Bacon Pigs	7 2	6 8	7 5	6 4
Porkers	7 11	7 4	7 9	6 9
LEAN STOCK :—	per head.	per head.	per head.	per head.
Milking Cows :—	£ *s.*	£ *s.*	£ *s.*	£ *s.*
Shorthorns—In Milk ...	22 4	18 14	22 1	17 19
,, —Calvers... ...	22 3	18 12	20 14	17 12
Other Breeds—In Milk ...	20 5	16 5	19 14	16 15
,, —Calvers ...	13 10	12 0	19 13	16 16
Calves for Rearing	2 6	1 15	2 16	2 0
Store Cattle :—				
Shorthorns—Yearlings ...	10 2	8 15	10 7	8 17
,, —Two-year-olds...	14 0	12 5	14 17	12 3
,, —Three-year-olds	17 9	14 16	16 7	14 7
Polled Scots—Two-year-olds	—	—	17 0	14 16
Herefords— ,,	15 4	13 14	—	—
Devons— ,,	13 17	10 12	—	—
Store Sheep :—				
Hoggs, Hoggets, Tegs, and Lambs—	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Downs or Longwools ...	40 1	32 9	—	—
Scotch Cross-breds ...	—	—	31 9	27 6
Store Pigs :—				
Under 4 months	27 7	20 5	22 8	19 10

* Estimated carcass weight.

† Live weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND and SCOTLAND in the Month of January, 1911.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Quality.	Birmingham. s.	Birmingham. d.	Liverpool. s.	Liverpool. d.	London. s.	London. d.	Manchester. s.	Manchester. d.	Edinburgh. s.	Edinburgh. d.	Glasgow. s.	Glasgow. d.
		per cwt.		per cwt.		per cwt.		per cwt.		per cwt.		per cwt.	
BEEF :—													
English	1st	53	0	53	6	54	6	51	6	54	0*	59	6*
	2nd	48	0	49	0	52	0	49	0	49	6*	52	6*
Cow and Bull ...	1st	47	0	45	0	46	0	46	6	45	0	46	6
	2nd	42	6	39	6	41	0	42	0	38	6	42	0
U.S.A. and Canadian :—													
Port Killed ...	1st	53	0	53	0	53	6	51	6	—		53	6
	2nd	47	0	48	6	50	0	49	0	—		46	6
Argentine Frozen—													
Hind Quarters...	1st	34	6	34	6	32	6	35	0	35	0	34	0
Fore ,, ...	1st	30	0	29	6	27	6	29	6	30	6	28	6
Argentine Chilled—													
Hind Quarters...	1st	41	6	41	6	41	6	41	6	42	6	41	6
Fore ,, ...	1st	30	6	28	6	30	0	29	0	31	0	31	0
American Chilled—													
Hind Quarters—	1st	—		—		57	0	—		60	0	—	
Fore ,, ...	1st	—		—		39	0	—		41	6	—	
VEAL :—													
British	1st	—		74	6	74	6	76	0	—		—	
	2nd	65	6	70	0	65	6	70	0	—		—	
Foreign	1st	—		—		74	6	—		73	0	—	
MUTTON :—													
Scotch	1st	67	6	74	0	71	0	73	6	62	0	69	6
	2nd	51	6	69	6	65	6	68	0	52	6	52	0
English	1st	65	6	69	0	62	6	69	0	—		—	
	2nd	51	6	64	0	57	6	64	0	—		—	
Argentine Frozen ...	1st	33	0	32	0	33	0	32	0	33	0	32	6
Australian ,, ...	1st	31	6	29	6	30	6	29	6	—		31	0
New Zealand ,, ...	1st	—		—		43	0	—		—		—	
LAMB :—													
British	1st	—		—		—		—		—		—	
	2nd	—		—		—		—		—		—	
New Zealand ...	1st	56	0	50	0	57	6	53	0	—		—	
Australian	1st	50	0	41	0	46	6	40	0	46	6	42	0
Argentine	1st	46	0	43	0	46	6	42	6	—		42	0
PORK :—													
British	1st	70	0	70	6	67	6	71	6	63	6	63	0
	2nd	64	0	64	0	62	0	67	0	56	0	59	6
Foreign	1st	—		—		63	0	—		—		—	

* Scotch.

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1909, 1910 and 1911.

Weeks ended (*in* 1911).	WHEAT. 1909.	WHEAT. 1910.	WHEAT. 1911.	BARLEY. 1909.	BARLEY. 1910.	BARLEY. 1911.	OATS. 1909.	OATS. 1910.	OATS. 1911.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Jan. 7 ...	32 9	33 6	30 5	26 11	24 11	23 11	17 5	17 2	17 0
,, 14 ...	32 8	33 8	30 8	27 1	24 11	23 10	17 5	17 7	17 2
,, 21 ...	33 2	33 9	30 11	27 3	24 11	24 4	17 8	17 6	17 4
,, 28 ...	33 0	33 6	30 11	27 6	25 0	24 5	17 9	17 4	17 3
Feb. 4 ...	33 4	33 7	30 9	27 7	24 10	24 5	17 10	17 7	17 5
,, 11 ...	33 8	33 4		27 8	24 9		17 11	17 11	
,, 18 ...	34 1	33 0		27 11	24 6		18 0	18 0	
,, 25 ...	34 5	32 7		28 0	24 2		18 0	17 10	
Mar. 4 ...	34 10	32 7		27 11	24 6		18 2	18 1	
,, 11 ...	35 8	32 6		28 4	24 1		18 2	18 0	
,, 18 ...	35 9	32 6		28 0	23 6		18 5	18 0	
,, 25 ...	36 0	32 9		28 0	23 7		18 6	17 11	
Apl. 1 ...	36 5	33 0		27 10	23 8		18 8	18 0	
,, 8 ...	37 4	33 6		28 0	23 1		18 10	17 11	
,, 15 ...	38 7	33 7		27 8	23 5		19 2	18 3	
,, 22 ...	41 4	33 7		28 2	23 0		19 9	18 3	
,, 29 ...	42 5	33 0		27 10	22 10		20 0	18 3	
May 6 ...	40 9	32 6		27 7	22 7		20 3	18 2	
,, 13 ...	41 6	32 1		27 3	22 0		20 6	18 1	
,, 20 ...	42 8	31 10		27 0	21 8		20 11	17 8	
,, 27 ...	42 6	31 3		26 3	21 4		21 0	17 10	
June 3 ...	43 1	30 2		25 7	21 8		21 3	17 10	
,, 10 ...	42 11	29 1		26 10	20 9		21 4	17 10	
,, 17 ...	42 7	29 0		26 10	18 11		21 6	18 0	
,, 24 ...	42 8	29 4		27 2	20 1		21 7	17 9	
July 1 ...	42 9	29 9		27 2	19 11		21 9	17 7	
,, 8 ...	43 0	30 4		26 4	19 5		21 8	17 4	
,, 15 ...	43 3	31 1		26 10	21 3		21 9	17 7	
,, 22 ...	44 0	31 11		27 4	19 9		22 5	17 5	
,, 29 ...	43 5	33 5		24 6	20 10		22 2	18 1	
Aug. 5 ...	44 9	33 9		27 4	20 5		22 11	18 3	
,, 12 ...	44 9	33 5		24 9	20 4		21 8	18 0	
,, 19 ...	41 6	32 11		23 11	20 11		19 8	17 11	
,, 26 ...	38 5	32 7		24 7	20 10		19 4	17 2	
Sept. 2 ...	37 2	32 2		26 3	22 10		19 6	17 2	
,, 9 ...	34 11	31 11		26 1	23 3		18 5	17 2	
,, 16 ...	33 6	30 11		26 5	24 3		17 9	16 6	
,, 23 ...	32 9	30 2		26 8	24 2		17 7	16 3	
,, 30 ...	32 2	30 1		26 9	24 4		17 2	16 4	
Oct. 7 ...	31 8	30 1		26 9	24 7		17 0	16 3	
,, 14 ...	31 4	30 2		27 0	25 1		17 0	16 2	
,, 21 ...	31 8	30 4		27 7	25 3		16 11	16 1	
,, 28 ...	31 10	30 4		27 9	25 4		17 0	16 2	
Nov. 4 ...	32 5	30 4		27 9	25 6		17 0	16 2	
,, 11 ...	32 5	29 11		27 7	25 4		17 1	15 11	
,, 18 ...	32 7	29 8		27 0	25 1		17 4	16 1	
,, 25 ...	33 0	29 11		26 8	24 10		17 3	16 4	
Dec. 2 ...	33 3	30 6		26 1	24 7		17 4	16 7	
,, 9 ...	33 3	30 9		25 7	24 3		17 3	16 9	
,, 16 ...	33 2	30 7		25 3	23 9		17 4	16 10	
,, 23 ...	33 1	30 7		25 2	23 10		17 4	16 9	
,, 30 ...	33 3	30 5		25 1	23 9		17 4	16 9	

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE, BELGIUM, and GERMANY, and at PARIS, BERLIN, and BRESLAU.

—		WHEAT.		BARLEY.		OATS.	
		1910.	1911.	1910.	1911.	1910.	1911.
		s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
France:	January	40 2	46 11	25 8	26 3	21 0	21 6
Paris:	January	42 0	48 3	24 8	26 2	20 8	22 9
		1909.	1910.	1909.	1910.	1909.	1910.
Belgium:	November	36 4	32 3	23 9	22 6	19 6	19 7
	December	35 7	32 9	23 7	22 10	19 5	19 2
Germany:	November	43 7	40 6	27 5	27 11	21 0	20 10
	December	43 10	40 8	26 7	27 8	20 9	20 8
Berlin:	November	46 8	43 0	—	—	21 7	20 6
	December	47 8	43 9	—	—	21 7	20 4
Breslau:	November	44 1	37 9	27 2* 25 1†	26 6* 22 11†	20 4	19 9
	December	44 6	37 10	26 10* 25 1†	26 8* 22 11†	19 10	19 7

* Brewing. † Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*, the prices for the German Empire representing the average of the prices at a number of markets.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of January, 1910 and 1911.

—	WHEAT.		BARLEY.		OATS.	
	1910.	1911.	1910.	1911.	1910.	1911.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
London...	34 6	31 10	24 3	23 3	18 4	18 9
Norwich	33 2	30 10	23 7	22 11	17 3	17 8
Peterborough	32 9	30 4	24 11	23 7	16 10	16 10
Lincoln...	33 5	30 2	25 9	24 10	17 0	17 4
Doncaster	33 6	30 6	26 1	23 5	17 2	16 7
Salisbury	33 9	30 5	25 5	23 0	17 3	17 4

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND and SCOTLAND in the Month of January, 1911.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Bristol.		Liverpool.		London.		Glasgow.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. a.	s. d.
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12lb.
British ...	15 0	14 0	—	—	17 0	15 0	15 0	—
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Factory	96 0	92 0	96 0	88 0	98 0	95 0	—	—
Danish ...	—	—	117 0	115 0	115 6	113 6	115 6	—
French ...	—	—	—	—	126 0	122 0	—	—
Russian ...	102 0	98 0	100 6	96 6	102 6	100 0	102 0	96 0
Australian ...	107 6	101 6	105 0	103 0	106 0	103 6	107 0	102 6
New Zealand	111 0	107 6	109 0	107 0	108 6	105 6	111 0	108 0
Argentine ...	107 6	105 6	106 0	104 0	106 0	103 6	106 6	106 0
CHEESE :—								
British—								
Cheddar ...	75 0	61 0	74 0	70 0	76 0	68 6	62 6	56 6
			120 lb.	120 lb.	120 lb.	120 lb.		
Cheshire ...	—	—	74 0	66 0	79 6	71 6	—	—
			per cwt.	per cwt.	per cwt.	per cwt.		
Canadian ...	60 c	57 6	60 6	57 0	60 0	59 0	60 6	58 0
BACON :—								
Irish	69 6	66 0	68 6	65 0	70 6	66 0	71 6	67 6
Canadian ...	63 0	61 0	62 6	59 6	63 6	60 6	61 6	58 0
HAMS :—								
Cumberland ...	—	—	—	—	114 6	107 0	—	—
Irish	—	—	—	—	118 0	108 0	91 0	79 0
American (long cut) ...	65 0	61 6	64 6	60 0	67 6	63 0	64 0	61 6
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British ...	15 0	13 4	—	—	14 9	13 9	—	—
Irish	13 3	12 3	13 1	12 0	13 1	11 7	14 6	13 3
Danish ...	—	—	13 0	11 0	13 10	11 4	14 7	12 9
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Langworthy ...	90 0	85 0	85 0	75 0	100 0	90 0	65 0	60 0
Scottish Triumph	80 0	75 0	65 0	60 0	82 6	73 6	—	—
Up-to-Date ...	88 0	76 0	65 0	60 0	81 0	71 6	55 6	50 6
HAY :—								
Clover ...	90 0	75 0	97 0	70 0	100 0	83 6	75 0	70 0
Meadow ...	77 6	60 0	—	—	89 0	66 6	—	—

DISEASES OF ANIMALS ACTS, 1894 to 1910.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(*From the Returns of the Board of Agriculture and Fisheries.*)

Disease.	January.	
	1911.	1910.
Swine-Fever:—		
Outbreaks	141	82
Swine Slaughtered as diseased or exposed to infection ...	1,523	491
Anthrax:—		
Outbreaks*	85	124
Animals attacked	95	152
Foot-and-Mouth Disease:—		
Outbreaks	—	—
Animals attacked	—	—
Glanders (including Farcy):—		
Outbreaks	17	25
Animals attacked	55	82
Sheep-Scab:—		
Outbreaks	121	138

* For 1910 the figures show the outbreaks reported, but for 1911 the outbreaks confirmed.

IRELAND.

(*From the Returns of the Department of Agriculture and Technical Instruction for Ireland.*)

Disease.	January.	
	1911.	1910.
Swine-Fever:—		
Outbreaks	17	2
Swine Slaughtered as diseased or exposed to infection ...	281	83
Anthrax:—		
Outbreaks	1	2
Animals attacked	1	2
Glanders (including Farcy):—		
Outbreaks	—	—
Animals attacked	—	—
Sheep-Scab:—		
Outbreaks	96	100

ADDITIONS TO THE LIBRARY.

[NOTE.—The receipt of *annual* publications of foreign agricultural and other departments, experiment stations and societies is not noted in the monthly list of additions to the Library. A list of these publications appeared in the *Journal* for October, November, and December, 1909.]

Agriculture, General and Miscellaneous—

U.S. Dept. of Agriculture, Bureau of Soils.—Bull. No. 61 :—The Electrical Bridge for the Determination of Soluble Salts in Soils. (36 pp. and plates.) [B. 40–5.] Bull. No. 73 :—Studies in Soil Oxidation. (57 pp.) [B. 40–9.] Bull. No. 74 :—Chemical Nature of Soil Organic Matter. (48 pp.) [B. 40–9.] Washington, 1910.

U.S. Dept. of Agriculture, Bureau of Plant Industry.—Circ. No. 71 :—Legume Inoculation and the Litmus Reaction of Soils. (11 pp.) [B. 28–5; B. 40–1.] Circ. No. 72 :—A Moisture Tester for Grain and other Substances and How to Use It. (15 pp.) [B. 22–5; C. 22–1.] Washington, 1910.

Saskatchewan, Dept. of Agriculture.—Bull. No. 21 :—Methods of Soil Cultivation Underlying Successful Grain Growing in the Province of Saskatchewan. (14 pp.) Regina, 1910. [B. 40–1; C. 22–1.]

Scottish Chamber of Agriculture and Associated Societies.—Report of Summer Conference held in Aberdeen on Friday, 1st July, 1910. (34 pp.) Edinburgh, 1910. [A. 12.]

Utah Agricultural College Experiment Station.—Bull. No. 109 :—The Nitrogen and Humus Problem in Dry-land Farming. (16 pp.) Logan, Utah, 1910. [B. 40–1.]

Reading, University College.—Agricultural Education, Report of a Deputation appointed to visit selected centres of agricultural education and research in Canada and in the United States. (131 pp.) Reading: University College, 1910. 1s. [B. 44–5, 44–17.]

Fraysse, A.—Contribution à la Biologie des Plantes Phanérogames Parasites. (178 pp.) Montpellier, 1906. [B. 16–3; B. 20–1.]

Transvaal Dept. of Agriculture.—Farmers' Bull. No. 130 :—Dry Farming. (7 pp.) Pretoria, 1910. [B. 56.]

Ministère Royal Hongrois de l'Agriculture.—Les Institutions Agricoles de l'État Hongrois. (19 pp.) Budapest, 1910. [A. 34.]

Memoirs of the Geological Survey, England and Wales.—The Geology of the Country around Padstow and Camelford. (120 pp. and plates.) London: E. Stanford, 1910. 2*s.* 3*d.* [B. 36.]

Memoirs of the Geological Survey, Scotland.—The Geology of East Lothian. (226 pp. and plates.) 4*s.* 6*d.* The Geology of Glenelg, Lochalsh and South-East part of Skye. (206 pp.) 3*s.* 6*d.* The Geology of the Neighbourhood of Edinburgh. (445 pp., plates and map.) 7*s.* 6*d.* London: E. Stanford, 1910. [B. 36.]

Board of Education.—Memorandum on the Principles and Methods of Rural Education. (48 pp.) London: Wyman and Sons, 1911. 3*d.* [B. 44–5.]

U.S. Dept. of Agriculture.—Farmers' Bull. No. 421 :—The Control of Blowing Soils. (23 pp.) [B. 52.] Bull. No. 425 :—Experiment Station work, LX. (24 pp.) [B. 46.] Washington, 1910.

U.S. Dept. of Agriculture, Office of Experiment Stations.—Circ. No. 105 :—List of State Directors of Farmers' Institutes and Farmers' Institute Lecturers in the United States. (13 pp.) [B. 44–17.] Bull. No. 231 :—College Extension in Agriculture. (86 pp.) [B. 44–17.] Washington, 1910.

University of Florida Agricultural Experiment Station.—Bull. No. 104 :—Pineapple Culture, VII. Nitrates in the Soil. (29–51 pp.) Gainesville, Florida, 1910. [B. 40–9; D. 37.]

Plant Diseases—

Indian Forest Memoirs, Forest Zoology Series.—Vol. I., Part III. :—A Note on the Lac Insect (*Tachardia lacca*), its Life History, Propagation and Collection. (82 pp. and plates.) Calcutta: Superintendent Government Printing, 1910. 1*s.* 6*d.* [E. 40–51.]

Agricultural Research Institute, Pusa.—Bull. No. 19 :—List of Names used in India for Common Insects. (49+xvii pp.) Calcutta: Superintendent Government Printing, 1910. 1*s.* 2*d.* [E. 40–1.]

University of Florida, Agricultural Experiment Station.—Bull. No. 103 :—Whitefly Control. (28 pp.) Gainesville, Florida, 1910. [E. 40–51.]

*Bourcart, E.—Leo Maladies des Plantes.** (655 pp.) Paris: Octave Doin et Fils, 1910. 9 fr. [E. 20–1.]

Live Stock—

U.S. Dept. of Agriculture, Bureau of Animal Industry.—Order No. 175 :—Regulations Governing the Certification of Recognised Breeds and Purebred Animals. (6 pp.) Washington, 1910. [F. 46.]

Georgia Experiment Station.—Bull. No. 90 :—Protein Requirements of Growing Cattle under one Year of Age. (83–105 pp.) Experiment, Georgia, 1910. [F. 68–1.]

Deutsche Landwirtschaft-Gesellschaft.—Arbeiten. Heft 170 :—Das anglonormännische Pferd. (124 pp.) Berlin: Paul Parey, 1910. [F. 64–1.]

Canada, Dept. of Agriculture, Branch of the Live Stock Commissioner.—Bull. No. 13 :—Beef Raising in Canada. (112 pp.) Ottawa, 1910. [F. 44.]

Dairying and Food, General—

Colorado Agricultural College Experiment Station.—Bull. No. 156 :—Butter Making: Clean Milk and Commercial Starters. (14 pp.) Fort Collins, Colorado, 1910. [G. 60–1.]

University of Wisconsin, Agricultural Experiment Station.—Bull. No. 197 : Methods of Paying for Milk at Cheese Factories. (24 pp.) [G. 56–5.] Research Bull. No. 7 :—Factors Controlling the Moisture Content of Cheese Curds. (72 pp.) [G. 66–1.] No. 8 :—Nuclein Synthesis in the Animal Body. (73–93 pp.) [G. 73–3.] No. 10 :—Some Improved Methods of Dairy Chemistry Analysis. (107–125 pp.) [G. 54–3.] No. 11 :—The Production of Volatile Fatty Acids and Esters in Cheddar Cheese and their Relation to the Development of Flavor. (127–154 pp.) [G. 66–3.] Madison, Wisconsin, 1910.

Michigan Agricultural College Experiment Station.—Circ. No. 7 :—Lactic Cultures for Dairy Purposes. (3 pp.) East Lansing, Michigan, 1910. [G. 54–3.]

U.S. Dept. of Agriculture, Bureau of Chemistry.—Circ. No. 62 :—A Comparison of Beef and Yeast Extracts of Known Origin. (7 pp.) Washington, 1910. [G. 73–1.]

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THE VALUE OF DIFFERENT CROPS AS GREEN MANURES.

A. D. Hall, M.A., F.R.S.,
Director of the Rothamsted Experimental Station.

Green manuring is a practice comparatively little followed in Great Britain, because wherever fodder crops are at all generally grown the land is suitable for sheep, and the standard custom of the country has always been to feed off the green crop with sheep. Wherever one sees vetches or mustard or rape being turned in by the plough on these light soils, it is generally because the farmer has an excess of keep and fears he will not be able to feed off the fodder crop in time to get the land ready for the next stage in his rotation.

On heavy soils, however, where sheep cannot be folded, green manuring might well be more practised, especially as its value in improving the texture of the soil will be even more felt than upon the sands and chalk. Indeed, it is not unlikely that we shall see more green manuring in the future if corn prices continue to rise. Feeding stock is not always the most profitable operation upon the farm, so that many men would be glad to grow corn crops more frequently and reduce the acreage under roots, with their doubtful return for the very considerable expense involved, were it not that they feel they must make as much farmyard manure as possible in order to maintain the condition of the soil. It is in supplying the humus and in ameliorating the texture of the soil that farmyard manure becomes so indispensable,

and though in this respect it cannot be replaced by artificial manures, yet a combination of artificial manures with the occasional ploughing in of a green crop will do everything that is necessary towards keeping the soil in the best possible condition.

It is not, however, the purpose of this communication to discuss either the value of green manuring or the difficulties encountered in practice, but only to set out certain experimental results which have been obtained at Rothamsted on the relative value of different crops used for that purpose. Whenever green manuring has been discussed or advocated, it has been assumed as a matter of course that leguminous crops are the best for the purpose, because of the nitrogen they gather from the atmosphere and add to the soil on being ploughed in. It is this atmospheric nitrogen that accounts for the benefits which a good clover crop confers on the succeeding crops in the rotation, even though the green manuring is only that due to the roots and stubble left behind after the clover has been cut; but the value of the clover is still more pronounced if the second growth is not cut or fed, but turned in so as to form a real green manuring, a practice which is not uncommon among the potato growers in the East of England. The classical illustration of the value of green manuring with leguminous plants is found in the reclamation of the sandy heaths of East Prussia by Schultz, who grew successive crops of lupins by the aid of mineral manures alone, and then turned them in until the soil had been built up. Considering this accepted power of the leguminous crops to enrich the soil in atmospheric nitrogen, it was somewhat surprising to find in the experiments at the Royal Agricultural Society's Farm at Woburn that Dr. Voelcker always obtained better results with wheat grown after mustard than after vetches, both crops having been ploughed in. The experiments at Woburn (see *Journal of the Royal Agricultural Society*, 1906, Vol. 67, p. 300, and 1908, Vol. 69, p. 348) have been repeated until no possible doubt of their validity can be left. On the average the yield of grain after mustard has been 50 per cent. higher than after vetches. When the Woburn results were first manifest, similar plots were started at Rothamsted on the Little Hoos field, in order

to see if the results obtained on the light dry land at Woburn would hold for the heavier and cooler soil that prevails at Rothamsted.

At the time the experiments were begun in 1904, this field was in a very poor condition, and more than usually short of organic matter, because it had been farmed for several years without any farmyard manure. No fertilisers were applied, but during 1904, 1905, and 1906, on the four plots rape, crimson clover, vetches, and mustard were sown, and turned in at the end of the summer. The treatment was repeated, because the land was in such poor condition that none of the crops were large, the vetches and mustard growing better than either the crimson clover or the rape. A crop of wheat was taken in 1907, after which, in 1908 and 1909, the green crops were repeated, a second crop of wheat being taken in 1910. The following table gives the results for the two crops of wheat.

TABLE I.—*Yield of Wheat per acre after Green Manuring. Little Hoos Field, Rothamsted.*

Previous Green Crop.	Dressed Grain. Bushels.	Dressed Grain Lb.	Offal Grain. Lb.	Total Grain. Lb.	Straw. Cwt.
1907. After mustard	29·9	1923	96	2019	22·5
1907. ,, rape	21·3	1376	75	1451	29·6
1907. ,, crimson clover ...	32·5	2096	294	2390	36·1
1907. ,, vetches	39·7	2542	210	2752	39·4
1910. After mustard	19·6	1247	34	1281	15·3
1910. ,, rape	20·8	1327	37	1364	16·3
1910. ,, crimson clover ...	30·8	1926	85	2011	27·0
1910. ,, vetches	34·4	2144	127	2271	34·7

From these figures it will be clear, as, indeed, it was to the eye, that the superiority of the wheat after the leguminous crops of crimson clover and particularly of vetches, is beyond any possible limit of experimental error. During the last year the value of the previous growth of vetches was particularly manifest, as the wheat on this plot possessed a fine colour, very free from blight, and yielded more than any of the manured wheat plots on the experimental ground. A plot in the same field, where the wheat had been manured with cake-fed dung after the preceding crop of barley, only

yielded 20·1 bushels; indeed, all the manured plots in this field gave very poor results.

The following determinations of the percentages of nitrogen in the grain and straw would indicate that the superiority in the yield of the plots on which the vetches and crimson clover had been grown was due to the greater amount of nitrogen there available in the soil, but the general superiority of these plots over the wheat elsewhere must be set down to the better condition of the soil brought about by the accumulation of organic matter.

TABLE II.—*Quality of Wheat Grown after Green Manuring.*

Previous Green Crop.	Weight per bushel. Lb.	Nitrogen in grain. Per cent.	Nitrogen in straw. Per cent.	Ratio of Grain to Straw = 100.	Ratio of Offal to Dressed Grain = 100.
1907. After mustard ...	64·3	2·065	0·276	59·9	5·0
1907. ,, rape	64·7	2·088	0·267	56·5	5·4
1907. ,, crimson clover	64·5	2·217	0·320	58·0	14·0
1907. ,, vetches ...	64·0	2·386	0·441	61·3	8·2
1910. After mustard ...	63·5	1·849	0·3162	74·8	2·7
1910. ,, rape	63·8	1·852	0·3054	74·6	2·8
1910. ,, crimson clover	62·7	1·888	0·3756	66·4	4·4
1910. ,, vetches ...	62·4	1·953	0·3595	58·4	5·9

The grain and particularly the straw of the wheat grown after vetches and crimson clover are much richer in nitrogen than the corresponding grain and straw following the non-leguminous crops, pointing to a greater amount of nitrogen in the soil available for the former crops.

Speaking generally, the results are what might have been expected from the known power of the leguminous crops to gather nitrogen from the atmosphere, but until the experiments have been repeated for a somewhat longer period of time it will be impossible to determine with any accuracy whether there has been any accumulation of nitrogen in the soil of the plots growing mustard and rape, though these crops are themselves incapable of fixing any nitrogen. One might expect that the soil bacteria, particularly the *Azotobacter,* would increase the nitrogen compounds of the soil when supplied with the carbonaceous matter which the green plant has drawn from the atmosphere. The *Azotobacter*

organism, which is present in Rothamsted as in most cultivated soils, is capable of effecting considerable fixation of nitrogen; but in order to do this it must be supplied with organic matter, by the oxidation of which it derives the energy necessary to bring the nitrogen into combination. Although it has been possible in the laboratory to raise the proportion of nitrogen in the soil by merely adding organic matter containing no nitrogen, and thus giving the *Azotobacter* material to work upon, the evidence that this process goes on in the field is still very scanty. Samples of soil, however, taken from this Rothamsted field at the beginning of the experiment, have been preserved, and further analyses after a few more green crops have been ploughed in may be expected to throw more light upon this question.

If the Rothamsted results, that vetches and crimson clover form good preparations for wheat because of the nitrogen they accumulate, are only in accord with what might have been expected, there still remains the entirely contradictory result at Woburn to explain. Dr. Voelcker has indicated that at Woburn the question is probably one of water supply; though the vetch crop does contain about twice as much nitrogen as the mustard which is turned in, it seems to leave the land in a drier and more open condition, and this on the light Woburn soil seems more to affect the crop than the extra nitrogen. It would, however, be unsafe to conclude that either the amount of nitrogen brought in by the two crops, or the effects upon the physical conditions of water supply of the soil are the only factors concerned. The processes of decay which the two materials have to go through before the nitrogen they contain can be available for the wheat crop, are very complex, and are likely to be different in two such contrasting soils as the cool, close Rothamsted land and the drier and warmer Woburn soil, and one is quite ignorant of the possible influence of the intermediate products upon the growing plant. It should be remembered that the opinions of practical men as to whether vetches form a good preparation for wheat are absolutely contradictory in different parts of the country. Some men have found that vetches are always followed by a good crop of wheat, while others hold that the result is invariably poor. It is interesting to find

that this divergence of opinion on the part of experienced men is illustrated so distinctly by the contradictory results at Rothamsted and Woburn; evidently here is material for a study of the causes in operation to bring about such different results both experimentally and in farm practice. From the practical point of view the Rothamsted results would seem to show that on strong land the farmer will do better to sow vetches or crimson clover for green manuring than one of the non-leguminous crops.

ACTION OF BEES IN POLLINATION.

W. B. LITTLE,

Instructor in Horticulture, Armstrong College, Newcastle-on-Tyne.

A DIVERGENCE of opinion still exists amongst fruit growers as to whether bees are an essential factor in the cultivation of fruit or not. Experiments on the point have been made during the past summer, the results of which seem to show that hive bees are necessary to ensure the distribution of the pollen, and thus confirm the American experiments which were reported in this *Journal* (October, 1910, p. 587).

The experiments were carried out on the Experimental Fruit Plots of the Cumberland and Westmorland County Council at Newton Rigg Farm School, the trees experimented upon being apples, black and red currants, and gooseberries. The method adopted in the case of the currants and gooseberries was to select an average sized bush before the flowers had expanded, and to place around it four posts driven into the ground. To these posts wire netting was attached, enveloping the bush, and this was then covered with white muslin, to prevent the entrance of all large insects. This remained over the bush for about three weeks.

In the case of gooseberries, the variety chosen was Whinham's Industry. After the netting was taken off it was found that some undeveloped berries still adhered to the branches, but these soon afterwards dropped off, and eventually there was not a berry left on the bush. This bush was afterwards denuded of its leaves by an attack of the sawfly caterpillars, and the tips of the shoots were injured by aphis.

The remainder of the gooseberry bushes grown in adjoin-

FIG. 1.—COMET RED CURRANT.
The result of the exclusion of insects is shown by the absence of fruit.

FIG. 2.
This bush was left unprotected and produced an excellent crop of fruit.

ing rows to which bees had free access carried an abundance of fruit, and were generally healthy.

Two varieties of currant, Comet Red and Carter's Champion Black, were protected from the visits of insects in the same way. The Comet Red is shown in Fig. 1. No fruit developed on this bush, and as a result it made excessive growth, both as regards foliage and shoots. The remainder of the red and white currants which were unprotected were laden with fruit, as shown in Fig. 2, which was a typical example. The protected specimen of Carter's Champion gave results similar to the Comet.

In the experiment with apple trees, varieties were chosen which were likely to carry a good crop, and one branch was covered with muslin before the flowers opened, the others being left exposed. In each case the covered branch bore no fruit, while the remainder of the branches carried a good crop. Fig. 3 shows a specimen of Cox's Pomona. The branch on the right, which is without fruit, was the one from which bees were excluded. The curled appearance of some of the leaves was due to the fact that the muslin had been fixed too tight to allow for their proper development.

It was anticipated that some persons might be inclined to attribute the non-setting or non-development of fruit to the exclusion of sun and air by covering with muslin. It was, therefore, decided to cover a branch after the flowers had been open for a few days, and had thus had an opportunity of being pollinated. The variety chosen was Early Victoria, and before the petals had fallen a branch was covered with muslin in this way; the muslin was not interfered with until August 4th, when it was removed. It was then found that six well-developed apples were borne by the branch. This particular branch is depicted in Fig. 4 by a straw which is hanging vertically. This result seems to prove that the exclusion of a certain amount of sunshine and air by the muslin in no way affects the non-setting of the fruit.

On the Abbeytown fruit plot branches of Golden Spine, Lane's Prince Albert, and Scotch Bridget were protected, and the results were in accordance with those at Newton Rigg.

At Brampton the results were even more decisive in favour

of bees as agents for pollen distribution. It was noticed that the trees and bushes on this plot very rarely carried satisfactory crops of fruit, and it was thought that this might be attributed to an insufficient supply of bees. The nearest hives were about half a mile to the east, and as the prevailing winds were from the west it seemed likely that the bees when leaving their hives would fly east for shelter. Mr. Avery, expert to the Cumberland Beekeepers' Association, assisted in the experiment, and placed in the orchard two hives of Italian bees, this variety being chosen to enable them to be distinguished from local bees when at work amongst the flowers. During the flowering period of the early varieties, the weather was unfavourable, but during occasional gleams of sunshine the bees were very busy. The later varieties were favoured with better weather. Mr. Avery kept them under observation and found that the percentage of bees other than Italian which visited the trees was very small, and on some occasions hundreds of these bees were at work when not another variety of insect could be seen.

Bushes of red and black currants and gooseberry, and branches of apples, pears and plums (one of each), were covered with muslin. On some of the bushes a few odd fruits developed, while on the branches of the large fruits not a specimen matured. The crops carried by the remainder of the trees and bushes were excellent, and there was not a single variety of either apples, pears or plums which did not bear fruit. It is inferred from this that the bees which previously visited the plot were insufficient in numbers.

Other insects besides bees may possibly play a part in the distribution of pollen, but it may be observed that comparatively few are on the wing at the time of the flowering of fruit trees. The whole of the colonies of wild bees, with the exception of the females, die off during winter months, while the females lie dormant until spring. The honey bees on the other hand, retain their full strength, and being well protected in the hives from inclement weather, they are ready on the first gleam of sunshine to sally forth in quest of honey, and in this way they distribute pollen.

In favourable seasons the wind undoubtedly is responsible for the distribution of a large quantity of pollen, but when

FIG. 3.—COX'S POMONA.
Insects were excluded from the branch to the right of the illustration, and this branch bore no fruit.

FIG. 4.—EARLY VICTORIA.
The middle branch was not protected from insects until *after* pollination had taken place and this branch produced well-developed apples.

wet weather is experienced in the spring it is probable that the pollen is not dry enough for the agency of the wind to be effective.

FRUIT BOTTLING.

J. UDALE,
Instructor in Horticulture, Worcester County Council.

THOUGH the method of preserving fresh fruit by the process of bottling has been practised for several generations, it is not yet so common as it deserves to be. There are two reasons for this: Firstly, the process is considered to be difficult; and secondly, there is a general impression that a special and costly apparatus for sterilisation is absolutely necessary.

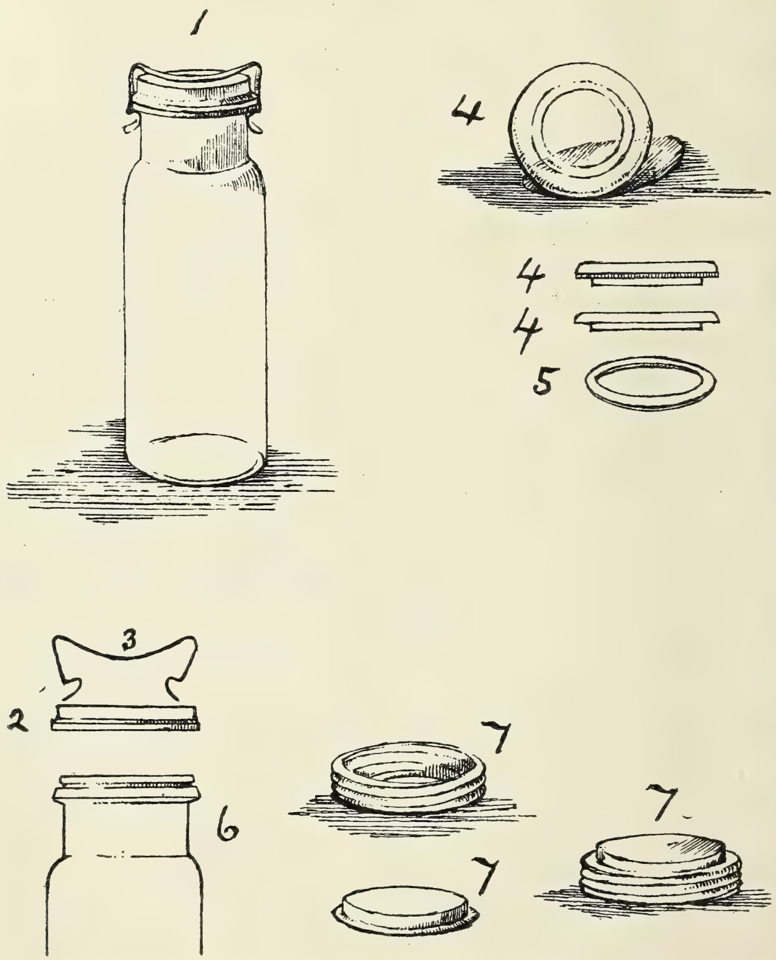
With regard to the first point it is only necessary to say that in domestic work there are few tasks more simple or easy to perform, and any ordinarily intelligent person may successfully bottle fruit. As to the second point, a patent steriliser is not necessary, and the writer, who commenced bottling fruit in 1903, has never used one. All that is really required is a large saucepan, fish-kettle, or some similar vessel in which water can be heated.

Bottles.—These may be obtained specially made for the purpose, through almost any ironmonger, at from three shillings to six shillings and sixpence per dozen complete, the price varying with the size and quality of the bottle. Many persons have a decided preference for bottles with glass tops instead of metal tops, and some like the "screw" tops; whilst others prefer the bottles in which the tops, covers, or discs are held in position by "spring" clips. When counting the cost of the process of bottling it is well to remember that the same bottles, when once obtained, may be used repeatedly until broken; the chief renewals required being rubber rings, which are used with bottles for rendering them air-tight.

It is absolutely essential that the bottles should be air-tight. An imperfectly-fitting rubber ring or cover will be sufficient to cause failure after perfect sterilisation; the rings and covers must, therefore, fit perfectly. As this cannot always be guaranteed, there will be an occasional bottle which

will not be successful. This should be used at once, or the contents emptied into a new bottle and resterilised.

Fruit Suitable for Preserving.—Any fruit may be preserved by the bottling process, either whole, or sliced.



1. Glass bottle with metal cap and spring fixed ; 2. metal cap ; 3. spring ; 4. glass cover or cap ; 5. rubber ring ; 6. top of bottle without cap ; 7. screw and cap for screw-top bottles.

Apples, pears, apricots, peaches, limes, shaddocks and lemons may all be used, though the bulk of bottled fruits consists of plums, gooseberries, cherries, raspberries, loganberries, and currants. Plums and gooseberries are probably the fruits most largely used. When once properly sterilised and

the bottles are quite air-tight, the fruit will keep for an indefinite period. The writer bottled some plums, gooseberries, raspberries, blackberries, and currants in 1903, and they are quite good at the present time.

The Use of Syrup.—Syrup is not necessary, though many persons think it is; pure water is as suitable as syrup, and being more transparent, adds to the beauty of the fruit after sterilisation. Moreover, a thin syrup spoils the natural flavour of the fruit without making it sufficiently sweet to render further sweetening unnecessary when used. Sugar, therefore, should either not be used at all, or it should be used at the rate of half a pound (and upwards) to one quart of water. Raw sugar should not be employed, as it renders the syrup "cloudy"; white lump sugar, however, leaves it tolerably clear.

Ripeness of the Fruit.—The degree of ripeness has a considerable effect on the appearance of the fruit after the bottling process is completed. Fruit should be *slightly under-ripe* for bottling, as the skin does not then so readily break during the process of sterilisation; with ripe fruit this can hardly fail to happen and the appearance is apt to be spoiled. In this respect under-ripe fruit will bear a higher temperature without injury than ripe fruit; but in no case need the temperature of the water in the kettle rise higher than 200° F., and in practically all cases 190° F. is sufficient. A thermometer is required to ascertain the temperature of the water.

Quality of the Fruit.—The fruit should be sound and without speck or injury of any kind. It is best gathered dry; but if it be damp or wet it should be sterilised a little longer. All stalks and large calyces, as in the case of the gooseberry, should be removed, and fruit of equal size should be placed in the same bottle. Mixed fruit, large and small sizes together in the same bottle, does not sterilise well, and has not a good appearance.

Filling the Bottles.—This is an important operation, as, if the bottles are imperfectly filled, the fruit after sterilisation will rise, and leave a large space at the bottom without fruit. Many have experienced this in their first attempts at fruit bottling. A stout stick or piece of wood, about twelve inches in length—blunt at one end and rather pointed at the other—

is very useful in arranging and gently pressing fruit into position in regular layers. The fruit should be selected of nearly equal size and then arranged in the bottle systematically, the fruit being pressed into place by means of the stick when necessary. The bottle should be filled to the top of the neck, still using a little force in packing if requisite.

As the fruit is placed in the bottles these may be filled up to within half an inch of the rim with clear water, or syrup made by dissolving half a pound of loaf sugar in one quart of water, when they will be ready for sterilising. In the case of bottles with screw caps, the latter may be placed on loosely and partly screwed down in order that they may be readily screwed down tightly directly the sterilising process is completed. In the case of bottles with caps (either glass or metal) and springs, those requiring rubber rings should have the rings softened in hot water, the cap placed on, and the spring fixed in position.

Sterilisation.—In the case of a patent steriliser the subsequent operations will vary with the kind of apparatus; but if the homely fish-kettle is used, it should be deep enough to take the bottles up to the shoulder in water. A board about one-half or three-quarters of an inch thick should be placed at the bottom of the kettle to prevent the bottles coming into direct contact with the kettle, and so causing their breakage, and a little hay should also be placed between the bottles to prevent fracture. In the absence of hay three or four folds of paper may be placed 'round each bottle. It is important to remember that there is a difference in temperature between the water in the kettle and the liquid in the bottles; if the temperature of the water has been raised rapidly there may be as great a difference as 40° or 50° F. The temperature both of the water and of the liquid in the bottles should, therefore, be raised slowly rather than rapidly to the desired maximum.

The caps, rubbers and springs, and screw-tops, having been placed in position, the bottles should be covered in cold water up to the shoulder, and the kettle placed over the fire or gas, and gradually brought to a temperature of from 165° to 190° F. The temperature necessary will vary with the kind and ripeness of the fruit; but a lower temperature

than 165° F. is quite unreliable, and a higher than 190° F. or 200° F. is unnecessary.

Immediately the highest temperature has been attained the kettle may be partly withdrawn from the fire, and the screw-caps should be screwed down as far as they will safely go. The temperature should then be maintained for fifteen or twenty minutes at about 165° F. in the case of small fruits such as gooseberries, currants, cherries, and raspberries, and at any temperature between 165° F. and 190° F. for plums, apricots, peaches, and pears. In the case of the latter, forty minutes at a temperature of about 165° F. to 170° F. will answer.

Screwing down the Caps.—When screw-caps are used it is most important to keep screwing them down tightly as the bottles cool and contract; the slightest access of air to the interior of the bottle may nullify the work, therefore this kind of bottle requires constant attention during the cooling process, and the tops must be constantly screwed down until contraction is completed.

Experiments.—As a result of experiments with plums sterilised in screw-top bottles in 1908, at various temperatures, it was found that sterilisation at 165° F. to 170° F. for ten minutes produced more satisfactory results than sterilisation at 190 to 200° F. and 212° F. respectively; and the samples are as beautiful in December, 1910, as they were immediately after bottling.

In these trials the largest varieties of plums have been most admired, the best of those sterilised at 165° to 170° F. being Belle de Louvain, Grand Duke, Monarch, Pond's Seedling, Washington, White Magnum Bonum, Coe's Golden Drop, Curlew, Diamond, Pershore, Sultan, and Abricotée de Braunau. Of those sterilised at 190 to 200° F. the following, out of ten varieties, were preferred: Belle de Louvain, Reine Claude de Bavay, and Red Magnum Bonum. Of seven varieties sterilised at 212° F. one bottle only kept its good appearance, viz., Red Magnum Bonum. The whole of the bottles were kept at the different temperatures for the same length of time, viz., ten minutes, after which they were taken from the fire and lifted out of the hot water a few minutes after. Fruit in bottles filled with water kept as well as fruit bottled in thin syrup.

UTILITY RABBIT BREEDING FOR SMALL HOLDERS.

P. E. WILSON.

THE breeding of domestic rabbits for the purposes of food and for export is more or less common with the Belgian peasantry, and in the Province of West Flanders rabbits are raised in such quantities that thousands of dressed carcasses are shipped weekly in the season to the London market. The imports of rabbits from Belgium in 1910 amounted to 47,800 cwt.

The existence of this trade suggests that small holders in some districts might find the supply of table rabbits a relatively lucrative industry if undertaken on a small scale in conjunction with poultry keeping and vegetable growing.

At present a limited demand for tame rabbits exists in London, and they are sold at Leadenhall and at the Smithfield poultry market. The best markets are found in the North, at Sheffield, Manchester, &c., and especially in towns in mining districts.

Suitable Breeds.—There are, for all practical purposes, only two suitable breeds of rabbit, and these are the Flemish Giant and the Belgian Hare Rabbit. Ordinary cross-bred or mongrel hutch rabbits may be set aside at once as useless for commercial purposes, as they are not large or heavy enough to produce young rabbits of good size that will mature quickly and form choice meaty carcasses. An exception may, however, be made in the case of the cottager, who may with profit keep a few of these cross-breds to supply his own household. Fed on the scraps from the house and garden, with an occasional feed of meal and oats, the young rabbits will be ready for killing in four or five months. In such a case, the cost for food is insignificant, and small cross-bred does are useful enough, but early maturity must be the aim of the small holder who breeds for market, and for this purpose ordinary cross-bred rabbits are useless.

The Flemish Giant Rabbit.—This is the largest breed of rabbit existing, and specimens bred true to type may weigh

anything from 11 to 20 lb. The standard of the National Flemish Giant Rabbit Club, given below, will explain the general characteristics of this breed.

Standard of Points for Flemish Giant Rabbits.

Size and weight to be as large as possible, bucks not less than 11 lb., does not less than 13 lb. 30 points.

Colour : Dark steel-grey with even, wavy ticking over the whole of the body, chest, and feet alike; belly and underpart of the tail pure white. 20 points.

Head and ears : Head to be large, full, and shapely, with large, bold eyes, dark brown in colour; ears to be carried erect, moderately thick; head and ears to be of the same colour as rest of body. 10 points.

Body : Body to be large, roomy, and flat, with broad fore and hind-quarters. Does to have a dewlap, evenly carried. 15 points.

Condition : Full short coat, firm in flesh. 10 points.

Legs and feet to be strong in bone, large and straight, colour to match body. 15 points.

The chief faults are sandy brown or red colour; small size; barred feet; camel back; narrow, wedge head; bowed legs; lapping ears.

Maximum number of points, 100.

When purchasing, it is desirable to go to a well-known and reputable breeder, preferably a member of the club, and see the rabbits before buying them. In the case of does, the type of rabbit required is one that is prolific, a good mother and a hardy animal bred from a massive strain. The standard says that bucks must not be less than 11 lb. and does not less than 13 lb., and this rule should be observed in buying. While show specimens are not necessary, pedigree stock is, for the simple reason that unless the animals are bred true, desirable qualities, such as great size, weight, &c., will be absent. It must not be forgotten also that by breeding the pedigree stock, the rabbit farmer has two markets, viz., the live and the dead, for in the former good prices are often obtained for really high-class animals.

The Belgian Hare.—The Belgian Hare (which is, of course, a true rabbit and not a hare) is a very different rabbit from the Flemish Giant, as the following standard, set by the National Belgian Hare Club, will show :—

Colour : Rich rufous red, carried well down sides and hindquarters, and as little white under the jaws as possible. 20 points.

Shape : Body, long, thin, and well-tucked-up flank, and well ribbed up, back slightly arched, loins well rounded, head rather lengthy,

muscular chest, tail straight, not screwed, altogether of a racy appearance. 20 points.

Ticking of rather a wavy appearance and plentiful. 10 points.

Ears about five inches, thin, well-laced tips. 10 points.

Eye hazel colour, large, round, bright, and bold. 10 points.

Legs and feet: Forefeet and legs long, straight, slender, well coloured, and free from white bars; hind feet well coloured. 10 points.

Dewlap: None. 10 points.

Size: About 8 lb. 5 points.

Condition: Perfectly healthy, not fat, but flesh firm, like a racehorse, and good quality of fur. 5 points.

Maximum number of points, 100.

It is probable that the chief disadvantage of this breed lies in the fact that many Belgian Hares are anything but hardy. This is due to "breeding in-and-in," which, in securing good colouring, fine limbs, head, &c., has resulted in some sacrifice of stamina. If, however, a good-sized animal were obtained, not strictly a show specimen, the offspring would probably be satisfactory, as the breed is certainly prolific and the does are generally good mothers. The chief value of the Belgian Hare lies in the first cross. If a massive Flemish Giant buck is mated with a large, well-built Belgian doe, the resulting young are undeniably excellent table rabbits; in fact, they are by many claimed to be the best table rabbits.

Breeding.—Does may litter any number from three to ten, but taking everything into consideration, about 20 youngsters per annum is an average for the usual breeding rabbit. The best time for breeding is undoubtedly the spring and summer, but if the rabbits are properly housed and well looked after, breeding may proceed slowly throughout the winter. More care is necessary in the upbringing of any litters that may be born in winter, but with a fairly large head of stock, it would probably be safe to assume that a proportion of the does would come into season throughout the colder part of the year, and, no doubt, the breeding of does in winter may be encouraged by warm housing and judicious feeding.

Fattening.—The fattening of table rabbits is important, the object being to place on the market at the end of fourteen weeks or so a rabbit that will yield a dressed carcass of $3\frac{1}{2}$ to 4 lb. of meat. The fattening starts from the day they are

born, for the more milk and the richer milk the doe gives her litter, the larger will the youngsters be when they are turned out of the nest about 16 or 20 days later. At this period they will start eating when the doe's food is placed in the pen. Nothing should therefore be given that is in any way likely to affect them adversely, such as damp greenstuff, whole grain, &c., but the actual fattening foods may be practically the same from this time till the day when the rabbits are fit to kill.

The following are among the most useful foods:—Sharps or coarse middlings, long bran or pollard, ground oats or barley meal, and chaffed clover hay and long meadow hay. The mash should be a crumbly mass and not wet or sloppy. A good suggestive dietary for fattening stock would be as follows:—

Morning.—Chaffed clover hay, mixed with warm boiled potato parings, and a few handfuls of sharps or pollard.

Mid-day.—Sliced or pulped roots (swedes, mangolds, &c.), with chaffed hay or meal.

Evening.—A mixture of pollard or long bran with Sussex ground oats, and a small allowance of oil cake added.

Well-dried greenstuff may be added, so long as care is taken to exclude wet and frosted or decayed leaves, &c. Cabbage leaves of all sorts, together with the thinnings and outside leaves of all garden produce may be used, and in season the many forms of wild green weeds, such as dandelions, plantains, hogweed, chickweed, dock, and so on. Mashes may always be served warm, but not too hot, and rabbits should always have fresh water to drink.

Marketing.—The time taken to fit a rabbit for the market cannot be definitely stated, as even in a litter of five rabbits, two or three nearly always do better than the others, and are up to the required weight at, perhaps, 10 or 12 weeks, while the others will go 14 or 15 weeks before being up to standard. With regard to weight, the small holder should study local conditions. It is safe to assert that carcasses weighing 8 lb., such as are sometimes found in the Ostend consignments, are practically unsaleable. The writer has found from his own experience that a rabbit weighing alive from 4 to 5 lb. is the most satisfactory size.

This will give in each case a dressed carcass of from 3 to 4 lb., though perhaps $3\frac{1}{2}$ lb. in the first case would be rather more convenient. It must be remembered that the class of buyers who purchase well-fed table rabbits would look with more or less disfavour on a carcass of 5 or 6 lb., as they would regard it as likely to be an old rabbit.

Some poultry dealers prefer to take the rabbits alive, killing as they require, and in this case it is customary for the producer to deduct 1 lb. from the live weight of each rabbit for pelt and offal. The price should not be less than 6*d.* per lb. when selling to the retailer, and this allows the latter to sell again at 7*d.*, 8*d.*, or 9*d.* per lb., according to demand, &c. The small holder will also often be able to sell direct to the retail shops, or, better still, to the consumer.

The Destruction of Stinging Nettles.

Two of our native species of "stinging" nettles are commonly troublesome in field and garden. One, *Urtica dioica* L., is a tall perennial with creeping rootstock, and occurs in arable and grass land alike. The other, *U. urens* L., is a much shorter plant, is an annual, and occurs chiefly in arable land.

The Great Stinging Nettle (*U. dioica* L.) is a pubescent perennial 2–4 ft. or more in height, and covered with stinging hairs which may cause severe pain on piercing the skin of man. The leaves are ovate-cordate or lanceolate, pointed, serrated or toothed, 2–4 in. long, stalked, and placed opposite one another on the stem in pairs. The small green flowers occur in panicles 1–3 in. in length which spring in pairs from the axils of the leaves, the male panicles being loose- and the female dense-flowered. Flowering takes place during the summer months—June to September. The stems may be single or branched. The rootstock is extensively creeping, and thus, together with reproduction by seeds, this weed is able rapidly to invade land on which it has once become well established. This nettle appears to grow well on most kinds of soil, but is most prolific on land in good condition, whether arable or grass. It is a serious pest as to

which information is frequently desired. Along the borders of meadows and pastures, particularly shady spots, it is often very troublesome, insidiously reaching further and further from the boundary into the field if nothing be done to arrest its progress.

In arable land this nettle is best combated by digging out and burning the rootstocks, following this up by thorough and continued cultivation and hoeing to destroy any further growth or any seedlings that may appear.

In grass land small patches may be dug out by hand and burnt, but this plan involves re-seeding. Another plan is to cover the small patches with large sheets of strong tarred paper, which should be pegged down and have a few heavy stones placed on the top. The exclusion of light results in the destruction of the herbage beneath. This plan also involves re-seeding of the destroyed patches.

In the case of either large or small areas this nettle may be dealt with by regular cutting from the time the shoots appear in the spring, cutting taking place each time the fresh shoots attain 6 in. to 1 ft. in height. This plan, thoroughly and regularly carried out, exhausts the reserves of food material stored up in the rootstocks, and eventually kills the weed. The eradication will be hastened by a dressing of salt (say at the rate of 5½ lb. per rod, or on larger areas 6 cwt. per acre) when the nettles are first cut in spring.

Experiments conducted in Germany* in 1909 with a view to destroying nettles on large areas, showed that the young shoots were destroyed in spring by spraying with a 15 per cent. solution of kainit, applied with an ordinary charlock sprayer. The shoots became black and died off, and the grasses won the mastery, so that at the time of hay harvest the area seemed quite free from the pest. Careful examination showed that the fresh delicate shoots from the rootstock appeared sickly and but little grown, while the rootstocks themselves were black and had begun to die. (As about 35 per cent. of kainit consists of common salt, it is probable that the effect of spraying with the solution of kainit is largely due to the salt contained therein.)

* *Prak. Blätter für Pflanzenbau u. Pflanzenschutz*, Aug. 1910, p. 97.

The Small Stinging Nettle (*U. urens* L.) is much smaller than the last species, attaining only 1–2 ft., or rather over, in height, while it is an annual. It is also smooth except for the stinging hairs. The stem is branched; the leaves are stalked, 1–2 in. in length, ovate-oblong, pointed, coarsely toothed, and placed opposite in pairs on the stem. The panicles or spikes of small green flowers are bisexual, $\frac{1}{4}$ to 1 in. long, and spring in pairs from the axils of the leaves. Wherever it occurs in arable land this nettle may be successfully combated by thorough and regular hoeing to prevent seeding for a year or two.

Injury to Water-cress Beds by Algæ.

During January the Board received specimens of an alga which was causing great loss in some Hampshire water-cress beds, the alga having the appearance of a "black cobweb" at the base of the plants, which degenerated and died off. The "black cobweb," as it was described, was identified as a fresh-water alga known as *Oscillatoria irrigua*, Kutzing, which with allied species may prove injurious when occurring in quantities in water-cress beds.

According to Bull. No. 64 of the Bureau of Plant Industry, U.S. Department of Agriculture, these algæ may be eradicated by the use of copper sulphate, one part to fifty million parts of water, or 1 lb. of the sulphate to 5,000,000 gallons of water. An estimate of the amount of water in the beds should be made, and then the copper sulphate, enclosed in a piece of sacking, may be slowly dragged through the water until dissolved.

In the Bulletin referred to, it is stated that "the success of the copper treatment for eradicating algæ from cress beds has been thoroughly demonstrated, and there is no reason why growers should have trouble from this cause in the future. The strength of the solution used for killing the algæ is so very much weaker than that which might affect the cress that there is no possible danger of injuring the latter if the solution is used by anyone capable of observing ordinary care. The question of how long a treatment is

effective must, of course, depend upon conditions, but it is believed that the application of the proper amount of copper once or twice a year will, in most cases, be sufficient to keep down any algal pest."

Sale of Eggs by Co-operative Means.

The following hints on the sale of eggs through a co-operative society have been furnished to the Board by Mr. Edward Brown, Secretary to the National Poultry Organisation Society. Information as to the formation of these societies, and the sale of eggs and poultry by their agency will be found in the Board's Leaflet, No. 111 (Co-operative Egg and Poultry Societies).

Collection of Eggs from Members.—The question of collection is of great importance. In order to ensure that supplies shall be of the best quality and command the highest prices eggs should be collected three times per week. This is the great stumbling block to many who have been accustomed to weekly marketing. Only, however, by frequent collection and rapid dispatch can the top returns be secured. The cost of collection must be considered. Where producers are conveniently situated, and the number of eggs available is large, the preferable way is to engage or provide a vehicle and collect from each farm, as by so doing regularity is ensured. But in small farm districts and where the population is scattered that system may prove too expensive. Under those conditions the responsibility must be thrown upon individual members. A plan which has proved very successful is the formation of sub-depôts to which members send their eggs, from which they are forwarded in bulk to the testing and packing station. It is essential that members who send in small or stale or bad eggs shall be penalised, and, therefore, each member numbers the eggs with a rubber stamp before they are sent in, by means of which the owners can be traced. Bad eggs should be returned, stale eggs and "smalls" paid for at a lower rate. In this way the standard of quality can be raised considerably.

Testing and Packing.—Upon careful testing much depends, and it cannot be too rigid. It is done by a powerful

lamp in a darkened room. A new-laid egg is full, *i.e.*, has but a tiny air space, is bright, and has no spots or dark shadows. Those which are classed as "new-laids" are, in societies affiliated to the National Poultry Organisation Society, branded with the Trade Mark of that society. They are then graded in accordance with the requirements of traders and immediately packed for dispatch. Packing should during warm weather always be done in a cool place, so as to exclude as much heat as possible from the cases, as the contents will thus travel and keep better than would otherwise be the case. Frequently there is considerable loss of quality and freshness from packing in sun-heated cases or in a hot room. It is generally most desirable to dispatch in the evening, so that the eggs may reach their destination early next morning, and to avoid allowing them to stand outside in the sun or rain. An hour's exposure of this kind will mean rapid deterioration through loss of quality. Every effort should be put forth to send in bulk and thus secure the most favourable railway rates.

Grading.—The better qualities of Colonial, Irish, and foreign eggs are graded to six sizes, namely, from 13 to 18 lb. per great hundred (120), rising by stages of 1 lb. per 120. These are carried in cases holding twelve great hundreds (1,440), packed between layers of straw or wood wool, and unless all were of the same size breakages would result. Every egg in a row must be held firmly, and this is only possible if all are of the same size. That is one reason, therefore, why close grading is desirable for such eggs. In this country, however, it is not necessary, nor does the market demand discrimination to that extent. In some of the manufacturing districts a big egg is always preferred, and "17 to 18 lb." eggs are popular, under the impression that the greater the bulk the more is the nutrition contained therein. This is a mistake, as the increased size is largely due to more water. As a rule, in the best trade, "15 lb." eggs command the best price, as these fit the egg-cups when served boiled. Small eggs are always much lower in value than the want of size warrants, owing to the fact that they are mainly used for cooking, and thus come into competition with cheaper grades.

Various appliances have been designed for the grading of

eggs, but these are not altogether satisfactory, owing to the differences in shape of eggs of the same weight. The plan usually followed is to sort by hand and eye. If one egg is known to be of standard weight, and it is placed in a tray, those which are below or too much above can easily after a little experience be picked out. There is no doubt that a basket or box of eggs in which all are uniform, presents a better appearance than where various sizes are mixed, even if the average weight per dozen is the same. Grading is, therefore, a question of selection.

A Successful Method of Selling Eggs in the United States.—An interesting attempt to meet the growing demand for high-grade eggs is reported from America. This is a form of combination, though not co-operative in our sense of the term. A poultry-keeper living near Brooklyn City, N.Y., set himself to supply direct to consumers absolutely new-laid eggs, for which he found a ready sale at high prices. By careful breeding and management he established a prolific strain of fowls, and thus regulated to some extent the supply. His trade grew rapidly and he brought neighbouring farmers into the scheme by supplying them with eggs for hatching from his selected stock, binding them to keep no other fowls, and to sell to him the eggs obtained at stated prices, which, however, were much better than they could otherwise obtain. All eggs are guaranteed as laid on one or other of the farms included in the combination within a few hours of delivery. At the place of receipt the eggs are packed in dozen "cartons" or boxes bearing the name of the Aurora Farms, and are dispatched at once by vans either direct to the houses of consumers or to retailers, who deliver them with other goods in the original packages and are compelled to sell at the agreed weekly prices. This trade has grown by leaps and bounds. The cost of delivery and packages is somewhat high, but not so great as if each farmer delivered his own, and is much more than compensated for by the enhanced returns. At first retailers were opposed to the scheme, but the best traders in Brooklyn are now glad to have regular supplies for their customers. There are many districts of England where similar conditions prevail, and a trial of the system might be made by individual enterprise or co-operation.

The Report (Part II.) of the Intelligence Division of the Board of Agriculture and Fisheries for 1909-10 [Cd. 5470. Price 1*s.* 5*d.*], deals chiefly with the administration by the Intelligence Branch of the Destructive Insects and Pests Acts.

American Gooseberry Mildew and other Destructive Pests.

Only one disease, American Gooseberry Mildew, was dealt with on administrative lines, and an account is given of the steps taken during the year, the prevalence of the disease in various districts, the sources of infection, remedies, &c.

As regards this disease, the following conclusions are given as the result of the experience of the year 1909-10.

1. American Gooseberry Mildew is wide-spread and deep-seated in certain counties in England, where gooseberry growing is practised on a commercial scale. There are, however, many gardens even in these areas which are unaffected, and many more which are only very slightly or slightly diseased.

2. Beyond these areas the disease has spread very little, and where it has appeared it is found chiefly in market gardens and only rarely in private gardens.

3. The conditions under which the disease spreads or becomes intense have not yet been fully ascertained.

4. Under certain climatic conditions, such as dry or cold weather, the disease does not spread with great rapidity and may even tend to disappear.

5. No sprays, hitherto tested, will destroy the disease or keep bushes free from attack.

6. The removal of all visibly diseased wood in the early autumn, as soon as the wood has ripened, reduces the amount of disease the following season, and will in most cases save the fruit, while the neglect to prune early will not only cause the bushes to become infected early the following season, but may even lead to a subsequent state of infection which may require some years of treatment to overcome.

7. The removal of infected bushes to other gardens is a fruitful source of infection if the plants are not properly pruned.

Under the Destructive Insects and Pests Order of 1910 various pests are scheduled, but no action under this Order

was taken in 1909-10. Information is given, however, respecting the position of this country as regards all the scheduled pests, and the reasons which led to their inclusion in the Order. In the case of the Large Larch Saw-fly, special inquiries were made into its prevalence and as to the influence of certain ichneumon and other flies in exterminating it.

Wart Disease of potatoes received much attention, and as a result of careful inquiry it is stated that—

1. The disease known as Wart Disease and by several local names has been present in Great Britain for many years, in some places for more than twenty. In most of the places where it is now found it has been present for seven to ten years, though not all the gardens in those localities are affected even now.

2. The disease spreads slowly, and in spite of the length of time it has been present in Great Britain it has only spread over a limited area. It is carried from place to place by infected "seed," and once it has become established in a new centre, it is spread chiefly by infected manure produced by animals fed on raw diseased potatoes.

3. The disease is very difficult to eradicate, and the infection lies in the soil for many years without losing its vitality.

A number of experiments on Wart Disease were carried out, and the information obtained was communicated to the public by means of a printed memorandum which appeared in this Journal, December, 1909 (p. 762).

An inquiry was also made as to the Felted Beech Coccus, and also as regards several local attacks of insects and fungi.

The Report is illustrated with various coloured maps showing the prevalence of American Gooseberry Mildew, the Large Larch Saw-fly, and Wart Disease.

Report on the Work of the International Agricultural Institute during 1910.

The Board have received from Mr. Percy C. Wyndham, the British Delegate on the Permanent Committee of the International Agricultural Institute at Rome, the following report, dated January 25th, 1911, on the work of the Institute during the past year:—

"I have the honour to report that the International

Agricultural Institute seems now to have overcome its initial difficulties, and that during the past year its labours have assumed a practical form. Substantial progress has been made towards the attainment of the main object in view, the construction of a certain and a wide basis for forming real prices of agricultural products. To accomplish this end a vast amount of preliminary work was entailed. Not only was it necessary to organise a competent staff within the Institute, but a certain uniformity of system had to be introduced into the statistical departments of the various countries adhering. As a first and preliminary step, a volume was published of the statistics of areas cultivated, and of animal production in the countries represented in the Institute. These were then asked to supply statistical information on a uniform plan adopted by the General Assembly of the Institute. As a result of the preliminary efforts, Germany, Great Britain, Italy, Belgium, Austria, Hungary, Mexico, Chile, Costa Rica, Greece, and China have agreed either to institute a new service of agricultural statistics or to reorganise their existing service, in order as far as possible to facilitate the work in contemplation. The extent to which it was possible to obtain official statistics having been ascertained, the Governments adhering were asked to supply certain definite information on a uniform plan. It was decided that, in the first instance, crop reports and other data should be published on seven staples: wheat, rye, oats, barley, maize, rice, and cotton. A knowledge of the volume of supply having been obtained, the Institute then summarised the figures for publication, co-ordinated the official reports, and reduced them to a common uniform standard. The system which the Institute has adopted, and which the countries adhering have agreed to follow, is that of "the single numerical statement" already in use in the Department of Agriculture in the United States. The normal yield in each particular country having been established through ascertaining the average for several years past, 100 is taken as the standard figure, and any increase or decrease is recorded; thus 101 would show an increase of 1 per cent., and 99 a decrease of 1 per cent. in the annual yield. The publication of the summary in the form of the 'single

numerical statement' was begun in July, 1910. Statistics for six countries were then given; in August the number was increased to eleven, in September to fourteen, in October to twenty-two, and in November to twenty-three. The bulletin published in November gives the area harvested for the years 1909 and 1910, and the totals and comparative averages of production of the various countries separately and of all the countries together. Thus, as regards the production of wheat, the area cultivated in 1910 amounted to 89,955,811 hectares, or 106·47 of the area cultivated in 1909. The yield per hectare has decreased from 10·04 to 9·43 quintals. The total production of wheat in the northern hemisphere for 1910 was 99·97 per cent. of the production of 1909.

"The same bulletin gave similar information with regard to the yield of rye, barley, oats, maize, and rice. It also gave the area under wheat in the southern zone, Argentina, Chile, and Australia, drawing a comparison with the areas of last year, and furnished figures on the sowing of winter crops in the northern hemisphere, with information as to conditions of soil and weather in various countries and districts.

"As has been already mentioned, the work hitherto undertaken has been largely directed to improving the system of rendering statistics followed in various countries, so as to enable the Institute as an international centre to issue its periodical summaries. The statistical bureau of Prussia has attempted for the first time to give a provisional estimate of the probable harvest. As regards the condition of crops, sixteen countries have, during the past year, furnished statistics in the form adopted by the Institute. These countries are Argentina, Australia, Bulgaria, Chile, Denmark, the United States, Great Britain, Hungary, Japan, Luxemburg, New Zealand, Holland, Roumania, Sweden, Switzerland, and Tunis. The Government of the Dominion of Canada are examining their present system to see how it can best be adapted to meet the requirements of the Institute.

"The work of the Institute, and in particular the publication of the 'single numerical statement,' appears already to have had practical results in steadying markets, in preventing the undue bearing down of prices in countries where local

harvests have been abundant, and in checking the undue rise where scarcity has prevailed. This salutary effect seems to have been particularly influential upon the stock exchange at Vienna and Budapest, where the report of an unusual abundance of local harvests was causing a collapse of prices. On the other hand, the corrective influence of the 'statement' tended to check the undue rise of prices in Italy, where the wheat crop of 1910 had only amounted to 80·7 per cent. of the yield of the previous year.

"Besides publishing the bulletin of agricultural statistics, the Institute now regularly issues a bulletin of economic and social intelligence, which deals with the history, development, and present extent of agricultural co-operation, insurance, and credit. A bulletin of agricultural intelligence and of the diseases of plants is also published. It is further proposed to publish in the statistical bulletin a statement of prices in the most important markets. It is hoped shortly to extend the statistical service so as to include other products beyond the seven staples already dealt with, and to give figures of importation and exportation.

"Amongst other questions which the General Assembly at its meeting in May next will be asked to consider is the possibility of establishing a meteorological service for obtaining data regarding hail, frost, floods, and drought, with the object of facilitating insurance, more particularly in those countries where crops are liable to injury through hail."

Flax-Growing in Ireland.

A Departmental Committee was appointed by the Irish Department of Agriculture, at the close of 1909, "to inquire into the present state of the flax-growing industry in Ireland, and the causes which are contributing to the decline of that industry." This Committee has now submitted a very interesting Report [Cd. 5502, Price 3*d*.], which, in addition to information specially applicable to Ireland, contains observations on some of the general conditions affecting the industry.

It is pointed out that the reduction in the cultivation of flax which has occurred in Ireland has been contemporaneous

with a similar decline in other countries. A decrease, in some cases a very serious one, has occurred in Austria, Belgium, France, and Germany; in Holland, Hungary, and Russia the area seems to be stationary, while in Great Britain cultivation has practically ceased. High prices for fibre now prevail, and it is anticipated that the world's acreage will increase. One reason which is given is that the production of cotton is not keeping pace with increasing requirements, and the price of cotton is likely to be maintained at a higher level. This is likely to create a greater demand for linen goods and to result in an improved demand for flax-fibre.

Various causes were assigned by witnesses who appeared before the Committee for the decline in Irish flax-growing, but the farmers were almost unanimous in pointing to low prices as the main cause. Many of them asserted that if they had a reasonable hope of obtaining an average price of *7s. 6d.* per stone for their flax, and a yield of about thirty-five stones per statute acre, *i.e.*, a gross return of about £13 per acre, they would continue to grow the crop, and that many of their neighbours who had given up the industry would be induced to resume.

The price is obviously dependent on causes over which the farmer has no control, but the monetary return from the crop is influenced as much by yield as by price, and it is suggested that farmers should endeavour to obtain a better return by improving the yield and quality of their fibre. The successful cultivation of flax depends, however, much more upon the suitability of the soil, seasons, and seed, and less upon the application of manures, than is the case with other crops. Moreover, flax is liable to serious depreciation in the course of the highly technical processes to which it must be subjected in its preparation for market. The cost, too, of growing and handling the crop is comparatively high—a circumstance which, of course, greatly increases the loss to the farmer when it is a partial or an entire failure. It is in great measure to this uncertainty of yield and risk of loss that the reluctance of farmers to undertake flax-growing is to be ascribed. Some of the causes of this uncertainty, such as those relating to the quality of the soil, are obscure and require investigation. For those such as unsuitable seasons

no remedy can be prescribed. There are, however, a number of others, for example, the inferiority of seed, and defects in handling, regarding which some action might be taken which would render the yield less precarious, and a number of suggestions are made by the Committee on these points.

A factor which influences to a material extent the cultivation of this crop in Ireland is found in the circumstance that flax is not an essential part of the rotation of crops, as practised in Ireland. Temporary grass, grain, and green crops are what the farmer usually cultivates. Their systematic rotation is essential to the system of husbandry suited to Ireland, as they are necessary either for the cleaning and the amelioration of the soil or for the maintenance of the stock kept upon it. Flax, however, is not required for either the one purpose or the other, and the farmer merely grows it as a stolen crop between two of the staple crops in his rotation whenever he happens to have a piece of land specially suitable for its growth, or when the prospects of a good price for fibre are attractive. So necessary are grass, grain, and green crops for the farmer's general operations, that, notwithstanding a bad return in any one year, he is bound to keep his land for a few years at least under the essential crops of the rotation. To lay it out to pasture or to change materially the rotation of staple crops would take some years. It is only a prolonged period of bad seasons or of depression of prices that brings about a general reduction in tillage and a corresponding increase in pastures of a permanent character. The rotation, therefore, exercises a steadying influence on the area under ordinary tillage crops, but does not so affect that under flax. Since flax is not an essential crop in a rotation, the farmer, in growing it, is determined by one consideration only, viz., the net return he will get for the crop. Accordingly, a year of profitable return is generally followed by an increase in the area, while a bad year has, of course, the reverse effect. This rule, however, only holds good so long as the area under tillage and rotation is maintained, and so long as the period of depression is not continued to such an extent as to admit of the art of growing and handling flax being entirely lost.

Among other points dealt with by the Committee are

questions of handling, marketing, the supply of labour, and the restrictions imposed by the Fishery Laws, and various recommendations are made with a view to the encouragement of the industry through the medium of the Department of Agriculture.

Moor Cultivation in Germany.*

The Board have received from Sir William Ward, H.M. Consul-General at Hamburg, a memorandum prepared by Mr. Vice-Consul Oliver on "Moor Cultivation in Germany."

As the extent of uncultivated moorland in Prussia still amounts to nearly two and a half million acres, moor cultivation is considered to be a branch of agriculture which calls for careful study and attention. The circumstances under which moors have been formed are very various, and consequently there is great difference in the soil to be dealt with, both as regards its quality and its constitution. The nature and quality of the moor soil depend upon the precise character of the plant life which contributed to the formation of the moor, and the plants again depend upon the soil and upon the condition of the water which furnishes them with nourishment. It may, therefore, be said that the quality of the moor depends upon the character of the soil and of the water acting on the vegetation. It is to be observed that these moors have been formed from the accumulated remains of dead plants by reason of their decay under the action of water and the partial or total exclusion of air. Where the vegetation is poorly nourished and there is a large quantity of water, moors are formed for the most part by peat moss, heather, and reed grasses. On the other hand, on a soil which is rich in plant food, the plants which contribute to the formation of moors are rushes, reeds, and a number of sour grasses. The principal kinds of moors are formed either from moss growths or from grasses. As the former are formed above the ordinary water-level, they are called upland moors

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* See also Leaflet, No. 203, "Utilisation of Peat Lands"; *Journal*, June, 1907, p. 146, and June, 1910, p. 205.

(*Hochmoor*), in contradistinction to lowland moors (*Niederungsmoor*), which term applies especially to grassland moors, the subsoil of which lies below the water-level, and is liable to be flooded.

According to the various methods of formation, the amount of plant food and consequently the method of cultivation is different in the case of highland and lowland moors, as appears from the following table.

	Nitrogen. Per cent.	Phosphoric acid. Per cent.	Potash. Per cent.	Lime. Per cent.
Upland moor	1·2	0·08	0·05	0·2
Lowland moor	2·3	0·20	0·15	3·36

The oldest system of moor cultivation is that adopted in Holland for the reclaiming of upland moors. Both in Holland and in Germany cultivation by burning is largely resorted to. The system consists in breaking up the surface of the moor, after it has been drained as far as may be necessary by means of trenches, &c., and in firing it in the spring so soon as it is sufficiently dry. By this means, the mass of surface roots is burnt away, and something like a soft soil is obtained. On the burnt moor, buckwheat, oats, and rye are cultivated. After three crops the yield declines, but after further burning oats may be sown, and after that, on dry moors, either rye or buckwheat again, until the remainder of the *Bunkerde* and heather has completely disappeared and the soil has become almost unproductive, which takes from five to eight years, according to circumstances. If the burning process is carried on too long the soil becomes completely unproductive.

Another method which has been largely adopted in the past is that of sanding the surface in the case of moors where the subsoil is composed of sand. The moor is first drained by means of open trenches or drain-pipes where open drainage is inconvenient. The drainage of upland moors does not require to be more than 24 in. deep for arable land, while for meadows it may be less. The sand greatly improves the quality of the top soil, and is usually obtained by excavating to a depth of about 3 ft. Owing to the heavy cost of putting a layer of sand 4 in. thick on the surface, this method has fallen into disuse.

At the present time the method which is generally recom-

mended is that of draining and manuring, and extensive investigations have been carried out by various Experiment Stations to ascertain the most rational system of cultivation.

Although moors may be made suitable for crops, they can with advantage be converted into meadows. In addition to draining and the formation of a bed for the germination of mixed grasses by careful preparation of the soil, great care must be taken to supply the soil plentifully with plant food. For upland moors which are poor in chalk a dressing of lime is given, as this stimulates decomposition and the neutralisation of acids, &c. For one acre of upland moor about 32 cwt. of slaked lime or 48 cwt. of lime marl would be sufficient. Also loam, clay, and sand marl may be used with advantage. The effect of the lime in these different forms depends to a large extent upon the even mixing with the soil.

For lowland moors which already contain a large percentage of lime, no manuring with lime is necessary. If it has sometimes been used with advantage, the reason is that it has had a neutralising effect on sour and insufficiently drained moors.

Lime should be used in conjunction with potash salts and phosphates. As the moor soil is, as a rule, wanting in potash and phosphoric acid, it is recommended both in the preparation of the soil for meadows and also for some years afterwards, that a somewhat large quantity of these manures should be employed, as, for example, about 8 cwt. to $9\frac{1}{2}$ cwt. kainit or $2\frac{1}{2}$ cwt. to 3 cwt. potash salt (40 per cent. K_2O) and about 5 cwt. to $6\frac{1}{2}$ cwt. basic slag to the acre. The object of this is to accumulate a store of plant food in the soil, as well as to replace the fertilising elements removed by the growing crops.

As the use of moors as meadows is not nearly so exhausting as the growing of hay, the soil in the former case requires much less manure. But where dairy cattle are kept and milk is sold, the fertilising constituents removed from the soil are much greater than where cattle are kept for fattening.

When the moor soil has received a somewhat excessive manuring and a residue of fertilising material has been collected, $2\frac{1}{2}$ cwt. to $3\frac{1}{4}$ cwt. kainit and $1\frac{1}{4}$ cwt. to $1\frac{3}{4}$ cwt.

basic slag to the acre per annum is found to be sufficient to keep a meadow in good condition.

Manuring with nitrogen is not general on lowland moors containing nitrogen naturally.

It is highly important to plant a suitable kind of seed on the meadows and pasture lands, and the results of the experiments at the experimental stations in this respect should be followed, and in order to get good results in the long run, careful and intelligent treatment is necessary, especially in regard to drainage and the avoidance of excessive dryness. It has been found that the regular use of a heavy roller and of harrows is in many cases to be recommended.

The improvement in moor cultivation has made it possible to obtain results from moorland meadows and pastures which compare favourably with the yield from the best grasslands. For example, the Moor Cultivation Association at Winnert obtained the following average crops per acre, viz., of rye, 12 cwt. to 20 cwt. grain, and 24 cwt. to 36 cwt. straw; of oats, 9½ cwt. to 19 cwt. grain, and 20 cwt. to 40 cwt. straw; of horse beans, 16 cwt. to 19 cwt. beans, and 28 cwt. to 40 cwt. straw; and of potatoes, 160 cwt. to 280 cwt.

Agricultural Credit in Italy.*

The first number of the *Bulletin of the Bureau of Economic and Social Intelligence,* published by the International Agricultural Institute, which was referred to in the December (1910) issue of this JOURNAL (p. 760), deals, among other subjects, with that of the present state of agricultural co-operation and credit in Italy. The first, and for many years almost the only, form of co-operative

* Articles on Agricultural Credit Abroad have appeared in previous numbers of this *Journal* as follows: "Agricultural Credit Banks," May, 1905, p. 96; "Agricultural Credit in France," June, 1905, p. 149; "Agricultural Credit in Hungary," July, 1905, p. 210; "Agricultural Credit in Belgium," August, 1905, p. 279; "Agricultural Loans in Queensland," September, 1905, p. 375; "Agricultural Credit in Germany, March, 1906, p. 725; "Agricultural Credit in Denmark," May, 1906, p. 118, and "Agricultural Credit Banks in Cape Colony, Natal, Transvaal, and Western Australia," February, 1908, p. 689; "Credit Banks in Austria," February, 1909, p. 867. Reference should also be made to Leaflet 214: "Agricultural Credit Banks" (containing suggestions for their formation in England).

enterprise in that country was co-operative credit. Societies known as Popular Banks were formed in the towns on the Schulze-Delitzsch principle adapted to the special conditions of Italy. Later, Rural Banks, formed on the Raiffeisen system, began to be established, and the number of these has grown rapidly year by year. The "rural banks" especially serve the small farmer, while the "popular banks" by preference deal with the proprietors of estates of large or moderate size and with tenant farmers.

Popular Banks.—These banks are essentially organs of credit for the great industrial and agricultural middle classes, and they have their headquarters generally in urban centres. They have the form of limited liability companies, and the nominal value of their shares varies from a minimum of 5 francs (4 shillings) to a maximum of 100 francs (£4). The popular banks assist agriculture in several ways: they discount the bills and acceptances of rural banks, and, in addition to the ordinary forms of credit, a large number of these banks grant loans to farmers upon mortgage, credits on current account, and loans upon guarantee.

The popular banks have no federal organisation, but there are several regional groups. In addition there is the Association of the Popular Banks, which was founded in Rome in 1876, and is principally a propagandist body. In 1870 the number of popular banks existing in Italy was about 50; at the present time there are about nine hundred with a total capital of £10,000,000, and with more than half a million members.

Rural Banks.—The rural banks complete in the country the work of the popular banks in urban centres. The first of the rural banks was founded at Loreggia in 1883. In ten years their number had grown to 129, and to-day, it is stated, that there are about 1,800 of these banks existing in Italy, of which about 1,300 have been founded by Catholics, while 500 are neutral in religion.

The rural banks, which by their constitution can deal only with their members, have for their principal object the provision of capital to the peasants (small freeholders, farmers, and metayers) for their different requirements, without excluding loans for purposes of consumption, or those not

directly devoted to agricultural purposes. They have no capital of their own, or at least no initial capital, but they receive savings deposits; and only when these are insufficient do they borrow the necessary capital from other institutions (such as popular banks and savings banks), or have recourse to private people who have disposable capital. The loans are made at an interest slightly higher than the ordinary interest paid on deposits or on money borrowed by the society. This little difference serves for the expenses of management and for the constitution of a reserve fund, capable of placing the bank in a condition of comparative independence and of greater stability. The services of the officials are gratuitous.

The reserve fund, in case of dissolution, is devoted to purposes of public utility. The maximum period of repayment is fixed by the rules, but there are two kinds of loans; the first of relatively short duration, not extending over a period of more than two years; the others with a longer duration, extending even to ten years. Loans of the first kind are generally renewed every three or six months; those of the second kind are repaid by instalments which include the interest.

Of the 500 non-Catholic banks, 130 belong to the National Federation of Italian Rural Banks, which was founded in Padua in 1887. It has its headquarters now in Rome, and its object is to unite the Italian rural banks "in one single federation, to encourage their diffusion, facilitate their development, to care for and protect their interests in every way." The Federation assists affiliated branches with advice, and in their negotiations with larger institutions, and also in the purchase of agricultural requirements, and, when requested, it conducts inspections and examines their accounts. It sends out lecturers on agricultural subjects, co-operation and thrift, and conducts experiments in the use of chemical manures. The Catholic rural banks are nearly all united in regional and provincial or diocesan federations, and they are almost all registered in the Italian Federation of Catholic Rural Banks which was recently formed at Bologna.

Other Institutions.—The agricultural banks of the district of Parma are somewhat different from those above described, but rather on account of their different historical origin than

any difference in economic principles. They are of a non-sectarian character, and are intended to benefit agriculture; hence they lend to applicants only when they have assured themselves of the agricultural purpose of the credit asked for. The banks of the district of Parma are 11 in all, and they belong to the "Federation of Agricultural Banks of the Parma Apennines" and deal with the Savings Bank of Parma; they thus act as intermediary institutions of this bank in its credit operations with the farmers.

The Bank of Naples is authorised by law to do agricultural credit business in the provinces of Southern Italy and in the Island of Sardinia with legally constituted societies and institutions, preferably those of a co-operative character. Similarly, the Bank of Sicily is authorised to do business through the medium of local co-operative institutions, that is to say, agricultural banks, in the form of co-operative societies with unlimited liability, and agricultural trading societies, constituted among agriculturists in the form of co-operative societies, or agricultural associations constituted as corporate bodies. According to the latest report of each of these banks, the number of intermediary institutions of the Bank of Naples was 1,542, of which 764 were "credit-worthy," and the total amount of loans made to such institutions was 4,200,000 francs (£168,000); the number of institutions having relations with the Bank of Sicily was 157, and the business done with them amounted to 4,000,000 francs (£160,000).

Mention must also be made of the Institution of Credit for Co-operative Societies, which was founded as a limited liability company at Milan, in 1904, with the assistance of the larger popular banks and of some co-operative societies. Its object is "to assist the development of co-operative distributive societies, co-operative productive societies, labour co-partnership societies, and credit societies for the benefit of artisans, clerks, peasants and metayers, and small freeholders, facilitating, by means of credit, the work of such societies." This Institution, which has a paid-up capital of a million francs (£40,000) and deposits to the amount of three million francs (£120,000), and has made a strong position for itself in nearly all Northern Italy and in several of the towns of

Central and Southern Italy, inaugurated in the first months of the past year a special "Section for Rural Banks." This Section will, in addition to granting loans and accepting deposits, discount bills, open current accounts, and, in different ways, encourage the work of the rural banks and institutions of a similar character.

For several years Italian co-operators have expressed the desire that the State should take the initiative in forming a central credit institution for the benefit of co-operative societies. In response to this desire the Minister of Agriculture introduced into the Chamber of Deputies on the 11th February, 1910, a Bill for the "Institution of the Bank of Labour and Co-operation." The initial capital of the Bank, fixed by the Bill at 15 million francs (£600,000), has already reached over 22 millions (£880,000), and it is believed that by the commencement of operations it will have reached 30 million francs (£1,200,000). The contribution from the State will be £400,000. The Bank is to be empowered to transact credit business with all the co-operative societies without distinction and to discount commercial bills given by them. The Bank will give preference to small credit transactions, speculative transactions being excluded. It will be managed by a council composed of representatives of the Ministry of Agriculture, the Treasury, Ministry of Public Works, the Bank of Italy, and of other institutions contributing to the capital, and will be under government inspection.

State Aid to Agriculture in Norway.

Some information as to the steps taken in Norway for the advancement of agriculture, dairying, and forestry, has been transmitted to the Board through the Foreign Office by H.M. representative at Christiania. The Central Administration is focussed in the Department of Agriculture, which, in addition to a headquarters staff, maintains a number of officials who travel about the country and give advice on matters connected with agriculture, live stock, and dairying. They also assist the Central Administration in carrying out public works for the

advancement of agriculture and dairying, and as they naturally come into close contact with the country population, they have every opportunity of ascertaining the conditions of the various districts. Proposals made by the Central Administration with respect to the carrying out of any new measures, are, as a rule, sent to the officials concerned for any remarks they may have to make before these are submitted to the Storthing, but the Central Authorities have frequently appointed special committees of experts when questions requiring more detailed inquiry were being discussed.

In addition to this advisory staff, there are several State establishments with special functions, viz., three chemical stations (including seed testing), two experimental stations for plant culture, three milk inspecting establishments, and three sheep breeding farms.

Aid to Agricultural Societies.—In each of the eighteen "amts" of the country there exists an agricultural society, and these societies are branches of the Royal Society for the Welfare of Norway. The work of this Society has mainly consisted in taking the initiative in new measures for the advancement of agriculture. When arrangements made by the Society are found to be of practical advantage and are working satisfactorily, they are taken in hand by the Central Administration. The Society also undertakes special work, mainly of a scientific nature. The State grant to this Society amounts to between £1,667 and £2,222 per annum.

The State contributes, towards the expenses of the local agricultural societies, an amount equivalent to the sums subscribed by the various districts. The agricultural society in Finmarken (the most northern "amt" in Norway) forms, however, an exception, as it is supported entirely by the State. The State grants to the agricultural societies amount to about £11,000 per annum. In most of the six hundred communes in Norway there are agricultural associations which are subsidiary to the Societies.

Attached to the agricultural societies are a number of travelling officials, whose work it is to advise and instruct the country population in their county in regard to agricultural and kindred matters. The county agriculturists, of

whom there are at present thirty-four, consequently act as advisers in questions regarding agriculture and domestic animals, and the county gardeners, who now number twenty, in those relating to horticulture.

In certain communes, district agriculturists and district gardeners have also been appointed. They are paid by the respective communes, and their work corresponds to that of the county officials, with the difference that their work is limited to one or two country districts. One-half of their pay is furnished by the State. Their number is at present thirty, of whom twenty-five are gardeners. These appointments are of comparatively recent date, and only exist, as yet, in five counties.

There are also travelling instructors in cow-keeping, dairying, and pig-breeding, who are appointed by the agricultural societies or by private associations.

Of other organisations that have been formed to watch agricultural interests, may be mentioned the Norwegian Farmers' Association, to which farmers from all parts of the country belong. This Association is not financially supported by the State.

Agricultural Education.—The agricultural schools have contributed largely towards the advancement of agriculture. An Agricultural High School was founded in 1897 with the object of providing instruction—on a scientific basis—in agriculture, dairying, forestry, horticulture, and surveying; there are, at present, about 150 students. The Budget of the School, which is financed entirely by the State, showed in 1910 an expenditure of about £23,000 and a revenue of about £11,000.

More elementary instruction in agriculture is afforded by seventeen agricultural schools belonging to different counties, and by three private schools. Three-quarters of the expenses of the county agricultural schools are defrayed by the State and one-quarter by the respective counties. About 500 pupils are passed out of these schools every year. There are also four private agricultural schools, with an aggregate of about 150 pupils per annum.

There exist, also, twenty schools for domestic science, which are supported by the State and the "amts." The

State grant for all these schools amounts to about £20,000 per annum.

In 1909 the State established a school for women teachers in domestic economy. About forty students a year pass through the courses at this school, and the grant in 1910 was about £1,660. For providing instruction in horticulture and dairying, the State has started seven schools for each subject. The State grants in 1910 were £1,740 and £1,600 respectively.

State Aid to Forestry.—About the middle of the nineteenth century it became apparent that the forests were being badly managed, and were decreasing in value; men were therefore sent abroad, principally to Germany, in gradually increasing numbers, to study the science of forestry. In 1857 a board of scientifically trained foresters was formed with the main object of managing the State forests. In 1863 a Forestry Law was passed. It does not restrict private owners in the use of their forest land, but it contains rules regarding the regulation of the rights of using forest land, the management of common land, and of forest land belonging to official residences, and regarding ecclesiastical endowments and other forest lands appropriated to Church livings or belonging to the State. The Law of 1893 contains regulations restricting the use of fire in woods and fields, and the Law of 1893 regarding the Preservation of Forests gives Local Councils the right of prescribing rules, which must be sanctioned by the King, for the management of private forests. This Law was amended in 1908.

The staff of the Board that manages the State forests consists of four inspectors of forests, twenty-five forest bailiffs, and five assistant foresters, one forest valuer, and one assistant valuer, all trained foresters. There are also eleven tree planters and 451 rangers who assist in the management of the forests.

In twelve counties foresters are maintained whose duty it is to advise private landowners in the treatment of their forests. The salaries and travelling expenses of these officials amount, at present, to about £2,778 per annum, one-half of which is paid by the State; the other half is, as a rule, paid by the respective counties.

Forestry Education.—In addition to the forestry section at the Norwegian Agricultural High School, which has a three-year course, the State supports two elementary schools of forestry at a cost of about £1,100. The course lasts one year, and the number of pupils averages forty-eight; instruction is free.

There are likewise three county schools of forestry, the expenses of which are paid by the counties in question, but which also receive a grant from the State.

The State has also instituted several nurseries, which furnish the plants required for the State forests and supply private landowners with plants. Several seed farms have been laid out by the State, whence the seed is derived for the use of the State and for sale to private persons.

The Norwegian Forestry Association.—In 1898 the Norwegian Forestry Association was privately formed for the furtherance of forestry. This Association has been strongly supported and has branches in all the counties. The State grant to the Society amounts at present to £6,256, this sum being used mainly in assisting private owners of forests to sow and plant trees and to drain swampy forest land. The grant from the State is paid out through the branch offices, which must procure a similar amount from the Local Councils or from private persons, as a contribution towards the cost of the work that is to be carried out. By the publication of a monthly Journal, and by issuing pamphlets from time to time, the Association endeavours to promote knowledge regarding the proper management of forests.

Use of Lime-sulphur-caustic-soda Spray. Warning.

In Leaflet No. 239 (*The Pear Leaf Blister Mite*) the Board have noted that experiments conducted in America favour the use of a lime-sulphur-caustic-soda wash, the wash to be applied when the trees are dormant. Theobald's formula for this wash is:—

Lime	30 lb.
Flowers of sulphur	30 ,,
Caustic soda	10 ,,
Soft soap	10 ,,
Water	100 gallons.

In the preparation of the wash for spraying the flowers of sulphur should be made into a paste with water and be poured over the lime. After boiling the mixture for a quarter of an hour the caustic soda should be added; the whole should be allowed to boil for a short time and then the dissolved soap may be added, bringing the water up to 100 gallons.

A case has just come to the Board's notice in which the mixed materials were boiled in a copper vessel, and when the wash was nearly prepared the vessel gave way, the result being that not only was the copper destroyed, but a great deal of the mixture was lost.

In the preparation of such a wash as that described above soluble sulphides are formed, and hot solutions of soluble sulphides readily attack copper, converting it into soft friable black sulphide of copper. Iron, on the other hand, is practically unaffected by such solutions, and therefore when sulphur is used in the preparation of a wash iron vessels should be employed.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

EXPERIMENTS WITH LIVE STOCK.

Fattening Bullocks (*Jour. South-Eastern Agric. Coll., No.* 18, 1909).—This experiment was instituted with a view to testing (1) the effect of substituting a treacle food, Molascuit, for roots in a fattening ration; (2) a light as compared with a heavy cake ration; (3) the effect of keeping the animals loose in a covered yard rather than tied in stalls. Eleven two-year-old Galloway bullocks were divided into three lots and fed as follows:—Lot I., four bullocks: 28 lb. roots at the start, rising to 56 lb. at the finish, 1½ lb. to 2 lb. linseed cake, 1½ lb. to 2 lb. cotton cake. Lot II., four bullocks: 2 lb. to 4 lb. Molascuit in place of roots, linseed and cotton cake the same as Lot I. Lot III., three bullocks: 28 lb. to 56 lb. roots, 2 lb. to 5½ lb. linseed cake, 2 lb. to 5½ lb. cotton cake. All three lots received also chaffed straw, hay, and rice meal, and were allowed as much water as they wanted. Lot II. with Molascuit drank about 5 gallons a day per bullock, against the 2¼ gallons of each of the two lots with roots. The animals were sent to the butcher as they became finished, so that the trial extended over a period of from three to four months' feeding.

* The summaries of agricultural experiments which have appeared in the present volume have been as follows:—Cereals, April; Cereals and Root Crops, May; Root Crops, June; Root Crops and Potatoes, July; Grass and Clover, August; Cereals, September; Miscellaneous, October and November; Miscellaneous and Live Stock, December; Live Stock and Dairying, January and February. The Board would be glad to receive for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

It is remarked in the Report that too much importance must not be attached to the results of the trials, as the number of animals in each lot was small. With this reservation, the following conclusions are stated :—

(1) The Molascuit cattle did better than the root-fed animals. This reverses the results obtained from last year's experiment, when the root-fed beast did rather better than those receiving Molascuit. Bearing in mind the small number of animals used, the results of both years would indicate that Molascuit may reasonably be used to replace roots for fattening bullocks, in the proportion of 1 lb. of Molascuit to 14 lb. of roots, when Molascuit is quoted somewhere about £5 per ton, and when roots are valued on the farm at 7*s.* 6*d.* per ton.

(2) The bullocks receiving a larger amount of cake, *i.e.*, 8 lb., did better than the two lots receiving only 4 lb. This result is, however, chiefly due to the very high gain, 3·01 lb. per day, made by one bullock. This was more than double that of either of the other two bullocks in the same lot.

(3) There appears to be little difference between the animals tied in stalls and those running loose in a covered yard, as far as rate of increase in live-weight is concerned. This corroborates the results obtained at Woburn, and at various experimental stations in America.

Feeding Cake to Cows on Grass (*Jour. South-Eastern Agric. Coll., No.* 18, 1909).—In this experiment an attempt was made to obtain some further information on the much-discussed question of feeding concentrated food to milking cows during the summer, in addition to a plentiful supply of grass. The idea of giving additional food is that as the summer advances the grass loses succulence and digestibility, and is not such an ideal food for milking cows as it is earlier in the season. In practice, extra food should only be given if it is found that such feeding yields a profit. But the financial aspect of the question cannot be decided by simply ascertaining the milk yield and finding if the cost of the food is more than made up by the increase in milk; the quality of the milk, the live-weight of the cows, and the effect of the food on the general health of the animal must also be taken into account. For this trial six spring-calving cows were chosen, and divided into two groups of three each. It began on June 11th and lasted till August 19th, or five periods of two weeks. One lot of cows received grass only throughout the time, but the other lot received also 4 lb. per day of mixed linseed and undecorticated cotton cake as follows in each period of two weeks :—Period I., none; Period II., 2 lb., morning and evening; Period III., 4 lb. in the evening; Period IV., 4 lb. in the morning; Period V., none. The milk of each cow was weighed at each milking, and samples were taken morning and evening and tested daily for the percentage of fat. Tables are given showing the effect of the feeding on the yield of milk, percentage of butter fat, and total yield of butter fat during each period of two weeks. It is concluded that—

(1) The feeding of 4 lb. of cake per day to cows getting a plentiful supply of grass has no appreciable effect in preventing the usual decrease in yield of milk due to advance in the period of lactation.

(2) The feeding does slightly increase the percentage of fat in the milk, but it cannot be said that the increase is permanent. With

changes in the times of feeding and quantity fed, made at short intervals, as in this case, such increase might be kept up over a longer period than is usually the case. When the cake was given in the morning the greatest increase in the percentage of fat was obtained, and this increase was most noticeable in the morning's milk.

(3) Owing to this slight increase in the percentage of fat, the total quantity of butter fat produced was increased. A gradual decrease took place during the trial, but this decrease was much less in the group of cows receiving cake.

(4) The cost of the feeding stuffs used is not equalled by the return obtained. Owing to the yield of milk not being increased, practically no return is obtained if the milk is sold. If butter or cheese is made, the foods give a return equal to about one-third of their cost. In this case the foods cost £1 9*s.* 10*d.*, while the extra butter produced was estimated to be worth 10*s.* 10*d.*; but, as mentioned before, other circumstances, such as the increase or decrease of live-weight, effect on general health, and manurial residue, have to be taken into account. The small number of cows with which the trial was made must also be borne in mind.

The Feeding of Store Bullocks in Summer and Winter (*Cornwall C. C., Rept. on Cattle Feeding,* 1907 *and* 1908.)—Experiments were made to find the average increase in live-weight of store steers about two years old, when grazed on second-rate pastures through the summer months. Three trials were made in 1907 with (1) six steers turned on to light uplands (where the pastures are broken up in rotation) for twelve weeks, from May 14th to August 8th; (2) ten steers on inferior pastures for nearly ten weeks, from May 15th to July 22nd; (3) ten steers running over light arable land or second-rate pastures of the same character as the above, for twelve weeks from May 21st to August 14th.

The following is a summary of the results:—

	Average live weight at start.		Increase per head per week.
	cwt.	qr.	lb.
(1)	6	2	24·1
(2)	8	1	23·1
(3)	7	2	19·1

It is remarked as a suggestive fact that the increase made by the bullocks in the first experiment, *viz.*, 24·1 lb. per head per week, is the same as that made in 1906, and again in 1907, by fattening beasts on luxuriant pastures with a liberal ration of purchased feeding stuffs.

A second experiment carried out by the Executive Committee dealt with the feeding of store bullocks in winter. Former experiments had suggested that store bullocks were fed inadequately in winter, so that after the expenditure of two or three months' keep there was a loss in live-weight. Accordingly in the winter of 1907 and 1908 trials were made on three farms.

On the first, eight stores under two years' old, receiving hay *ad lib.* in a yard, lost, between December 15th and May 7th, an average of 45 lb. each. On the second farm eight bullocks were fed on straw *ad lib.* and a few roots, with a run over inferior pastures. From December 12th to March 30th the loss in live-weight averaged 63 lb. per beast. In both cases the beasts were treated in the way usually adopted by local farmers in wintering their stores.

The third experiment was with a system of heavier feeding. Eleven bullocks on the experimental farm were fed liberally, and were given good hay and grass throughout the winter. During four months, instead of a decrease as in the other cases, the total increase in live-weight, when reduced to carcass value, was equal to about 25*s*. per head. On the other hand, each bullock consumed at least a ton of hay in addition to grass.

Another point, however, is made. The bullocks made good progress during November and December, and again in February and March, but during a cold spell in January they lost no less than 22 lb. per head. In another experiment, carried on at the same time, in which steers were receiving 6 lb. of maize meal per head, in addition to grass and hay, they made during this same severe weather a gain of 3 lb. per head, and it is suggested that if the bullocks in the former experiment had also received some additional feeding during the severe weather, the gain in live-weight at the end would have been much greater. It is also remarked that the bullocks, in addition to their increased weight, were in good condition in April, and would have been better had they been properly cared for in January.

A comparison was also made between allowing bullocks a run over grazing land and confining them in yards. Eight beasts were given a run over fifteen acres of useful grazing land, with a large open shed and an unlimited supply of hay. Eight others were confined in a large open yard with a similar shed and supply of hay. Each lot had 6 lb. per head of purchased feeding stuffs daily. The result appeared to be distinctly in favour of confinement, the weekly increase per head in live-weight during three months being 14 lb., compared with 10·3 lb. in the case of those with a run over pastures.

Pig-Feeding Experiments (*Jour. South-Eastern Agric. Coll., No.* 18, 1909).—English and foreign barley were compared as foods for pork production. The foreign barley gave a rather better return than the English, on the average ¼ lb. less of the foreign barley being required for each 1 lb. gain in live-weight. This is the same result as that obtained on the College farm in the winter of 1906–7. It is claimed, therefore, that foreign barley has a rather better pork-producing value than English, and that its use may be recommended when its price is below or equal to that of English grinding barley.

A trial was also made of the value of coal slack as an addition to the diet of fattening pigs.

Breeding from Ewes at an Early Age (*Jour. South-Eastern Agric. Coll., No.* 18, 1909).—The object of this experiment is to ascertain to what extent breeding from ewe tegs (*i.e.*, tupping at seven months of age instead of at one year seven months) can be carried on without appreciably reducing the size, vigour, and constitution of the ewes.

Fifty Border-Leicester—Cheviot, or Half-bred ewe tegs, were divided into two lots, and one lot was mated with Southdown ram lambs in November and December. Both lots were wintered on grass with a few roots and hay, and were treated exactly alike until a fortnight before lambing, when the in-lamb lot received more nutritious food. Seven of the ewe tegs thus mated proved barren, but the remaining eighteen gave birth to twenty lambs, one of which died soon after birth. Two of the tegs had twin lambs, but one of them produced insufficient

milk to rear both lambs. With this exception the ewes were good mothers, and their lambs have done well. There were no cases of difficult parturition, possibly on account of the small type of ram used (Southdown) and the naturally narrow head of the Half-bred, a feature which is inherited by its offspring. The ewes were weighed at eight months, and at one year eight months of age, and the figures show that in comparison with those that were not tupped, each ewe that produced and reared a lamb was, on the average, seventeen pounds lighter. It is estimated in the report of the experiment that the production of a lamb entails a loss of only 5*s.* 8*d.* on the ewe. The ewes are being kept on; both lots were put to ram when one year eight months of age, and the weights will be taken again at two years eight months.

Milk Records (Edinburgh and E. of Scotland Coll. of Agric., Bull. 22).—This inquiry into the yield and composition of the milk of the dairy herd at the Midlothian and Peebles County Asylum, Rosslynlee, has been carried on since 1905. Accounts of the results obtained in former years have appeared in the *Journal* for July, 1907, p. 205; March, 1909, p. 953; December, 1909, p. 753; and February, 1911, p. 930. They have emphasised two points in particular—first, the importance to the dairy farmer of keeping systematic records of the yield and quality of the milk of his herd, and secondly, the necessity of milking at as even intervals as possible in order to maintain a uniform quality in the morning and evening milk.

The average yield and percentage of fat of the ten best cows in each of the last five years are shown in the following table :—

	1905–6.	1906–7.	1907–8.	1908–9.	1909–10.
Average yield in gallons ..	991	912	1,008	811	928
Average percentage of fat .	3·69	3·74	3·63	3·76	3·80

It is remarked that the greatest difference in the average yields is that between the years 1907–8 and 1908–9, when it amounts to no less than 197 gallons per cow, which for the ten cows would give a difference of nearly 2,000 gallons. This was undoubtedly due to the many changes in the herd in the two years, and shows the difficulty and uncertainty attending the selection in the open market of cows for dairy purposes. Were the keeping of certified milk records a general practice, the difficulty of selection would be considerably lessened.

The introduction into the herd of heifers bred from the heaviest yielding cows in it continues. There are at present four in the herd, and two others are expected to calve during the present year. It is, of course, too soon at present to pronounce an opinion on their merits. The effect of so many young cows has rather been to reduce slightly the average yield for the year.

DISEASES OF LIVE STOCK.

A New Test for Tuberculosis in Cattle (Univ. Coll. of Wales, Aberystwyth, Agric. Dept., Bull. 1).—During the last few years a new test for tuberculosis has proved of great service in the case of human patients. The method is the introduction of a special tuberculin into the eye, and its simplicity is a considerable advantage. As Continental investigations on the use of this test for cattle proved inconclusive, a trial was made on the College farm in 1909. The plan followed was to test a number of animals by the eye method, to apply the ordinary

tuberculin test eight days afterwards, and finally to test the results by making post-mortem examinations. The cattle tested were twelve three-year-old bullocks and two aged cows. The bullocks were intended for slaughter in any case, so that there was no difficulty as regards the post-mortem examinations. The cows were both in somewhat low condition, and there was some doubt whether either was free from disease. The method of applying the test is to drop a small quantity—usually one or two drops—of the preparation of tuberculin into one eye. If tuberculosis is present the injection is followed, within twelve hours, by inflammation and the formation of pus. Of the animals tested two of the bullocks and both cows reacted, in the case of one bullock the reaction being only mild. After eight days all the animals were subjected to the ordinary tuberculin test, except one cow, which was near calving, but was tested three months subsequently. The result was that one of the cows only, and none of the bullocks, reacted. The final test was a post-mortem examination. It was not, however, considered necessary to conduct such an examination except in the case of the animals that reacted. The two bullocks that had reacted to the eye test were sent to the butcher within a week after the completion of the second test, and they were found to be perfectly free from disease. In their case, therefore, the eye test proved misleading. After this result it was decided to keep the two cows on till the summer. During the summer the one that had reacted to both the eye test and the usual tuberculin test became still more emaciated and developed a cough. She was consequently killed, and was found to be very badly affected with tuberculosis. The other cow, however, had greatly improved, and in view of the result with the two bullocks, she was kept on for the time being in the herd.

The position was, therefore, that of three animals reacting to the eye test, one reacted to the ordinary tuberculin test, and was found on examination to be badly diseased, while the other two did not react, and were free from disease.

Professor Bryner Jones concludes from this evidence that the test is not to be relied on for the purpose of indicating the presence of tuberculosis in cattle with accuracy, although a definite opinion cannot be expressed from the result of this one experiment. He points out, also, that the test is far more difficult to carry out in cattle than in man, and it is not to be inferred from this experiment that the test would not be equally reliable in the case of cattle were it possible to ensure that the cattle would submit kindly to the operation. It is often impossible to induce an animal to stand still, especially when its head is held in a somewhat unnatural position. Moreover, the eye has to be forcibly opened, and the eyelids cannot be kept apart in a restless animal without considerable pressure. There is thus a possibility of irritation and injury to the eye even when the greatest care is exercised. This risk, which can never be wholly absent in the case of cattle, must necessarily detract from the value of the test in practice, not because the injury which may be thus caused is likely to be in itself serious, but because the effect of such an injury on the eye might easily be mistaken at any time for a genuine reaction.

The Cellular Elements present in Milk (*Jour. Brit. Dairy Farmers' Association, Vol.* 24, 1910, and *Vol.* 25, 1911).—It has

been known for many years that cellular elements occur in milk, and that, in certain circumstances, such as an attack of mastitis or inflammation of the udder, they increase very largely in number. They have been regarded as leucocytes or pus cells, and attempts have been made to diagnose mastitis by estimating the number of cells present. This investigation was undertaken on behalf of the British Dairy Farmers' Association for the purpose of getting further information as to the nature of the cells and the causes of increases in their number. Samples of milk were obtained from five farms, six cows being selected at each, and their mixed milk was examined weekly for the greater part of the lactation period, with special examinations of the individual milk of cows that developed any affection of the udder. The investigation was made by counting the number of cells in the milk, and by microscopic examination of them, an improved method of staining the cells for this latter purpose being adopted. The opinion formed by the investigators is that an increase in the number of cells does not admit of any inference of the existence of a diseased condition of the cows supplying the milk. The udder is an organ so open to stimuli of a varied nature, and yet showing practically only one form of response to such stimuli, that the cause is not to be diagnosed from the effect produced. With regard to the nature of the cells they find that the vast majority differ materially from leucocytes, and conclude that they are not pus cells derived from diseased tissues.

Prevention of "Struck" in Sheep (*Jour. South-Eastern Agric. Coll., Wye, No.* 18, 1909).—A method of protecting sheep against "struck," which was used with success by the Departmental Committee on Louping Ill and Braxy against those diseases, has been tried for two years by Mr. T. W. Cave. These latter are bacterial diseases which occur almost entirely at a particular time of the year. Dr. Hamilton found that during the remainder of the year the blood of sheep has a distinct bactericidal action and destroys the bacteria that are the cause of these diseases when they gain access to the sheep. In addition, those sheep which have thus overcome the disease are rendered immune, and resist its attack during the dangerous period of the year.

"Struck" is also a disease that occurs at one particular season, generally during March, April, and May, and this suggested a trial of the treatment. This consists in giving to sheep in the safe period of the year drenches of a culture of the bacilli in glucose broth. During January, 1908, 255 sheep were each given two doses with a fortnight's interval. The records kept by the shepherds showed that the sheep were protected against struck for two months after the second dose. During these two months not a single treated sheep died from "struck," while fourteen of the untreated animals died from the disease. Unfortunately the immunity did not last sufficiently long to carry the sheep safely through the whole of the dangerous season. In order to lengthen the time of immunity in 1909 a much larger amount of the culture was given in three doses, the last being given on February 25th, five weeks later and nearer to the dangerous season than the year before. The number of sheep treated was 190, and they were put, with 190 untreated sheep, on land known to be dangerous. Unfortunately for the trial the mortality from "struck" was very light this spring, but four

of the untreated sheep died, and only one of the treated sheep. Mr. Cave considers that dosing with living cultures of the bacillus just before the period of danger may give sufficient immunity, at any rate to diminish considerably the loss that usually occurs each spring. The method was found to be perfectly safe, as eleven hundred doses were given without causing a single death.

Diseases of Live Stock (*Board of Agric. and Fisheries, Rept. of Proceedings under Diseases of Animals Acts,* 1909).—This is a report on investigations that have been carried on during the year 1909 at the Board's Laboratory in connection with the following diseases:—Epizootic Abortion, Contagious Granular Vaginitis and Sterility in Cows, Trichinosis, the "Cruels" in Sheep, Scrapy, Johne's Disease, Poisoning by bracken, Sheep Scab and Swine Erysipelas.

In connection with Trichinosis some experiments showed that pigs may become infested with *Trichinae* through the medium of diseased rats. A case of the disease in a pig, which had led to the illness of two people eating the pork, was probably due to infestation through the agency of diseased rats which over-ran the piggery.

The preventive inoculation of pigs against swine erysipelas has been tried with success. In a piggery where the disease occurred every year, ten pigs, weighing from 105 to 250 lb., were inoculated on July 28th, 1908, by the usual method (*see* Leaflet 227), and ten others of about the same weight that had not been inoculated were put with them. On September 11th an outbreak of swine erysipelas occurred amongst the uninoculated pigs and some other pigs on the premises, but none of the inoculated animals became ill. The veterinary surgeon reported later that the owner had resolved to make a practice of inoculating every pig over 100 lb. on his premises.

It was decided to try the effect of giving serum followed at six days' interval by the dose of living bacterial culture. This plan was found to give good results, and it has since been the method followed. The veterinary surgeon reported on October 23rd, 1909, that between August, 1908, and September 30th, 1909, he had inoculated 724 pigs on these premises, and that only two pigs had shown recognisable symptoms of swine erysipelas, and these two cases were very mild. At the time of report there were 649 pigs on the establishment. The virus of swine erysipelas is believed to be kept up in the soil of an infected piggery for years, and the fact that two pigs became affected with the disease during this observation shows that the virus was still present in this infected piggery, although the vast majority of the inoculated pigs escaped the disease.

WEEDS.

Charlock Spraying (*Univ. Coll. of N. Wales, Bangor, Agric. Dept., Bull.* 1, 1909).—Spraying was carried out in 1909 at ten centres with solutions of 15, 20, and 25 lb. of copper sulphate in 50 gallons of water, forming 3, 4, and 5 per cent. solutions. The results confirm those of previous years. The 3 per cent. solution was occasionally effective when the conditions were favourable, whereas the 4 and 5 per cent. solutions practically destroyed all the charlock.

Effect of Weeding and Hoeing on Roots (*Univ. Coll., Reading, Results of Expts.*, 1909).—This experiment has been carried out with mangolds for three years, with the following results :—

	Tons per acre.			
	1907.	1908.	1909.	Average.
Singled only	15¾	16¾	30¾	21
Once hoed	33½	30¼	32½	32
Twice hoed	37¾	36¾	34	36¼
Kept clean by hoeing	39½	38	31¾	36½
Kept clean by hand weeding	40	38¼	34	37½

The 1909 results are not so striking as those of the first two years. The ground had carried a crop of maize in the previous year, and was thus left in a condition fairly free from weeds, owing to the successive hoeings that crop received. Taking the average of the three years, one hoeing added eleven tons per acre to the crop, compared with the rows on which singling only and no weeding was done. A second hoeing added about four tons more per acre. Further hoeing and weeding by hand gave but a small increase. The fact that the hand-weeded rows gave the heaviest crop appears to show that the benefit of hoeing is due to the killing of the weeds rather than to improvement in the texture of the soil.

Destruction of Charlock by Calcium Cyanamide (*Univ. Coll. of N. Wales, Bangor, Agric. Dept., Bull.* 1, 1909).—A preliminary experiment to test the effect of calcium cyanamide on charlock was tried at Madryn. Two plots, each one-twentieth of an acre in size, were dressed with calcium cyanamide, one at the rate of 120 lb. per acre, and the other at the rate of 80 lb. per acre. The charlock, of which the rough and smooth leaved varieties were present, was rather irregular in growth, some of the plants being in full flower, while others were just commencing to bud. The dressings were applied on June 3rd. A fortnight later little or no effect could be seen, either on the charlock or on the corn. All the weeds present had recovered from the temporary check which they had suffered.

Destruction of Thistles (*Field Expts. in Staffs. and Salop, and at Harper Adams Agric. Coll., Joint Rept.*, 1909).—In 1907 and 1908 dressings of salt and of sulphate of copper were found to have little effect on thistles, and in 1909 this treatment was given up and only cutting practised. Three cuttings in the year were found so effective that at the end of the second year there was little left to deal with, and in the third year the plots were practically cleared.

By checking the growth of the thistle above ground in the early summer the development of the underground stem is hindered and the plant cannot spread so freely. The second growth which follows is not so strong, and the seed-producing stems are not so luxuriant. Second cutting in July further weakens the vigour of the plant, and this is further checked by the third cutting. The same treatment in

the second season leaves a very much reduced crop, and by the time of the third cutting the number of thistles remaining is small.

Foreign Experiments.

Influence of Bacteria on Phosphoric Acid in the Soil (*Centralblatt für Bakt, &c. II. Abt. Bd.* 28, *No.* 22/24).—These experiments were carried out with a view to ascertain the part played by bacteria in the change of insoluble phosphoric acid into soluble phosphoric acid in the soil. The method followed was to place some well aerated, sifted and sterilised soil in a flask, kept in the dark at a temperature of 30° C., and to inoculate this soil by the introduction of the bacterial culture, the effect of which was to be tested. The sample of soil was aerated by a stream of air from which carbon dioxide (CO_2) and ammonia (NH_3) had been removed, apparatus being provided to measure the amounts of these two gases in the stream of air after passing through the soil. The energy of the bacteria could be measured by the amounts of these gases, and the effect of the bacteria was determined by comparing the condition of the phosphoric acid in the sample of soil under consideration with a sample of soil which was similarly treated except that it was left uninoculated.

For the purposes of the experiments phosphoric acid was reckoned as soluble when dissolving in 2 per cent. acetic acid. Each portion of soil was kept under treatment for two months. It was found that, far from changing the insoluble form of phosphoric acid into the soluble form, the bacteria played a negative part, since in spite of a rich formation of CO_2 the amount of soluble phosphoric acid in the soil was reduced to an important extent. This decrease is to be ascribed either to the use of soluble phosphoric acid by the bacteria themselves or to a purely chemical reaction. A process was going on during the experiment, however, changing insoluble acid into the soluble form, but it was quantitatively weaker than that opposed to it. The process of CO_2 formation (*i.e.*, the energy of the bacteria) reached its maximum in the first five to ten days of the experiment, a gradual weakening being noticed in the course of two months: the total amount produced in that period was found to be between ten and twenty times greater than in the case of sterile soils.

OFFICIAL NOTICES AND CIRCULARS.

The Board of Agriculture and Fisheries are prepared to entertain applications from owners of stallions of any recognised breed for their registration in accordance with the following regulations:—

Regulations for the Annual Registration of Stallions.

1. Every stallion submitted for registration must have been entered or accepted for entry in the stud-book of its breed, viz.:—Thoroughbred stallions in the General Stud-book; Hunter Sire, Shire, Clydesdale, or those of any other breed in the stud-book of their respective breeds. The owner of the stallion must, if so required, produce to the Board a certificate from the keeper of the stud-book to

the effect that the stallion offered for registration has either been entered in the stud-book, or will appear in the next volume.

2. No application in respect of a stallion under three years old will be considered.

3. Stallions will be inspected and registered free of charge if serving at a fee of £10 or under, exclusive of the groom's fee, provided that they are presented for examination at the place and time appointed by the Board for the purpose. When the fee is over £10 the examination will be at the owner's expense. The necessary veterinary examination will be carried out by the veterinary surgeon appointed for the purpose by the Board.

4. A stallion will not be registered or be retained on the register unless it is free from hereditary unsoundness and otherwise fit for breeding purposes.

If the report of the veterinary surgeon shows that the stallion is suffering from a disease or deformity, which in his opinion renders it unfit for breeding purposes, the owner will be so informed. He will be entitled to have the question of the existence of the disease or deformity determined by a referee appointed by the Board, if he furnishes the Board with a certificate by a veterinary surgeon to the effect that the stallion is not so affected and gives security for the cost of the examination by the referee which will be payable by the owner unless the appeal is successful. The privilege of appeal is not to extend to a stallion which has been rejected on appeal in a previous year.

5. The Board reserve to themselves the right, without assigning any reason and without inspection or veterinary examination, to decline to register any stallion or to remove it from the register. No appeal will be allowed against a decision of the Board under this rule.

6. The Board reserve the right to cause any registered stallion to be inspected and examined by their officers at any time.

7. If the owner of a registered stallion is detected in any fraudulent practices in connection with this scheme, all his stallions will be liable to be struck off the register and the owner may be debarred from obtaining any further benefit under the scheme.

8. Forms of application for the registration of stallions can be obtained on application to the Secretary, Board of Agriculture and Fisheries, 4 Whitehall Place, London, S.W.

N.B.—Registrations must be applied for each year.

Memorandum on Light Horse Breeding for the Guidance of District Committees.

1. A District Committee is appointed to supervise the arrangements for the service of mares by a stallion to which a premium has been awarded by the Board. Their services are honorary.

2. A District Committee will usually consist of three members and one of them will be invited to act as its Honorary Secretary or Corresponding Member to whom all communications from the Board will be addressed.

3. Members of a District Committee will be supplied by the Board with copies of the Regulations and Conditions of Service for Premium

Stallions (H^{33}) and of Nomination and Service of Mares by Premium Stallions (H^{32}).

4. Members of a District Committee will be asked—

(*a*) to issue the nomination tickets for the service of mares by a premium stallion at the prescribed fee (not exceeding £2 for a King's premium and £1 for a Board's premium stallion);

(*b*) to inform the stallion owner concerned when they do so;

(*c*) to obtain, whenever possible, the payment of the service fees at the time of issuing the nomination tickets and if unable to do so to obtain from the persons to whom the tickets are issued written agreements to pay;

(*d*) to give receipts for all payments received, and

(*e*) to remit such payments to the stallion owner concerned at such time, or times, as may be mutually agreed upon by them.

The necessary books of nomination tickets, receipt forms, notification forms, and forms of agreement to pay will be supplied by the Board.

5. The service season is from April 1st to July 31st, and nomination tickets are only available during that period.

6. The Board would be glad if Members of a District Committee would assist the stallion owner to secure a sufficient and suitable number of mares for his stallion, and with this object they should inspect the service book of the stallion owner at intervals and sign the same when they do so.

7. At the end of the service season the stallion owner will submit his service books and a statement of the number of mares served to the Corresponding Member, who should sign it, if to the best of his knowledge and belief it is correct.

8. The Corresponding Member should also give to a stallion owner at the close of the service season, a certificate to the effect that the stallion has regularly travelled the district, if he is satisfied that this is the case.

9. Members of a District Committee should at the close of the service season return all books, forms, &c., which have been supplied to them to the Secretary, Board of Agriculture and Fisheries, 4 Whitehall Place, London, S.W.

Regulations and Conditions of Service for King's Premium and Board's Premium Stallions.

1. The service season is from 1st April to 31st July.

2. A Premium stallion is not to be exhibited for *competition* during the service season.

3. *In addition to the payments that are to be made by the Board* in respect of a stallion to which a Premium has been awarded, *payments of service fees are also to be made by the owners of mares served,* except in the case of mares for which nominations for free service have been issued, in which case the fees will be paid by the Board. The service fee of a King's Premium stallion is not to exceed £2, and that of a Board's Premium stallion £1, exclusive of a groom's fee of 2*s.* 6*d.*, in each case payable on the occasion of the first service.

4. (*a*) Nomination tickets for *free* service by a specified stallion will on application be issued by the Secretary of a County Committee for a limited number of mares in the district.

(*b*) Nomination tickets for the service of mares at a fee by a specified stallion will be issued by members of the District Committee concerned on application by the owner of the mare provided that payment of the prescribed service fee is made at the time of issue, or an undertaking given to pay the same. Receipts for payments of service fees are to be obtained and shown to the stallion owner on the occasion of the first service.

Persons issuing nomination tickets (free or otherwise) are to inform the owner of the stallion of the names of the persons to whom they have issued them. The tickets are to be handed to the stallion owner on the occasion of the first service, and he is to give a receipt for them and for any service fees paid direct to him.

(*c*) Mares can also be accepted for service without nomination if the stallion owner so agrees and arranges for the collection of the prescribed fees.

5. The owner of a stallion may refuse service if the payment for the same has not been made prior to or on the occasion of the first service.

Before service takes place the stallion owner or his representative should satisfy himself that no erasure or alteration appears on a *free* service ticket, inasmuch as the Board may in such circumstances withhold payment of the service fee unless the alteration or erasure is initialed by the Secretary of the County Committee. In the event of any difficulty arising in this connection the owner of the stallion should communicate with the Secretary of the County Committee.

6. A service ticket is not transferable, and is available only for the mare for which it is issued and for the stallion mentioned thereon.

7. The owner of a stallion or his representative may require hobbles to be used for any mare served.

8. The trial of a mare is equivalent to a service, and the owner is liable for the payment of the fee.

9. A receipt from the stallion owner for the payment of the service fee or for a nomination ticket will, on production to the stallion owner who issued it, entitle the mare in respect of which it is issued to a second and third service, if necessary, should she come in use again on two future occasions during the service season.

10. In accordance with the conditions prescribed by the Board for the award of Premiums, a Premium stallion is to serve at the prescribed fees :—

(*a*) not less than 50 mares, if so required; and in addition

(*b*) any mare which has been purchased and leased to a farmer or other person by a County Committee; and

(*c*) without fee, any other mare on production of a free service ticket, for which payment will be made by the Board.

Service fees will not, however, be paid by the Board in respect of more than 90 mares served by the same stallion in a season.

11. The owner of a stallion or his representative may refuse to allow his stallion to serve a mare suffering from a contagious disease, but he must immediately notify the reason for the refusal to the person

by whom the nomination was issued and in the case of a leased mare to the County Committee.

12. A mare can only be served at the risk of her owner or his representative.

13. Each owner of a Premium stallion will be supplied by the Board with a book in which records of mares served by his stallion are to be kept.

14. On completion of a first service (whether "free" or otherwise) the owners of the stallion and mare, or their representatives, are to sign and countersign respectively the service ticket in the service book of the stallion owner, who is to detach and forward the same to the Board after having duly filled up the counterfoil in the book.

Nomination tickets (whether "free" or otherwise) are also to be forwarded to the Board at the same time by the owner of the stallion or his representative.

15. On completion of a second and third service the owner of the mare, or his representative, is to sign the service book of the stallion owner in the space provided on the counterfoil.

16. The service books, together with the prescribed Form ($H^{\underline{39}}$) for payment of fees, duly signed by the corresponding member of the District Committee, and the "travelling" certificate, if any, are to be forwarded to the Secretary, Board of Agriculture and Fisheries, 4 Whitehall Place, London, S.W., at the close of the service season, and in no circumstances later than the 31st August in each year.

17. The service book is also to be submitted to a member of the District Committee for his information not less frequently than once a month, or at any other time at his request. It is on such occasions to be signed and dated by the member in the space provided for the purpose.

18. The Board reserve the right to withhold from the owner of any stallion any payment or privilege in the event of any contravention of these Regulations by him or his representative.

19. In any case of dispute the final decision rests with the Board.

Regulations and Conditions of Nomination and Service of Mares by King's Premium and Board's Premium Stallions.

1. The service season is from 1st April to 31st July.

2. A mare is, in accordance with the following regulations, entitled to service by a Premium stallion if accompanied by :—

(a) A ticket of nomination for *free service;* or

(b) a ticket of nomination for service at the prescribed fee; and on certain conditions without nomination.

Nominations for Free Service.

A limited number of nominations for the free service of mares will be available for distribution in those countries in which Premium stallions are serving. These nominations will be allotted by the Board to County Committees to be awarded by them.

3. A nomination for free service represents the amount of the service fee payable by an owner of a mare for service by a King's

Premium stallion (*i.e.*, not exceeding £2) or a Board's Premium stallion (*i.e.*, not exceeding £1) as the case may be.

4. The *only* payment to be made to the owner of a stallion by the owner of a mare, to which a nomination for free service has been awarded, is a groom's fee of 2*s.* 6*d.*, payable on the occasion of the first service.

5. The prescribed form of application for a nomination of a mare for free service by a Premium stallion can be obtained from the Secretary of a County Committee, and when duly filled up it is to be returned to him.

6. The mare, for which an application is made, must be the *bona-fide* property of the applicant, and no application will be considered by a County Committee before or after the dates fixed for receiving such applications.

7. Before a nomination for free service can be awarded it must have been certified to the County Committee by a veterinary surgeon approved by them that the mare is (*a*) not over 12 years of age; (*b*) that she is free from diseases, abnormalities, or defects likely to be reproduced in her progeny; (*c*) that she is free from any clinical appearances of contagious disease; and (*d*) that she is of good conformation and otherwise suitable for breeding purposes. The veterinary inspection will be made free of charge, provided that the mares are presented for examination at the place and time appointed by the County Committee.

8. When a nomination for free service has been awarded to a mare, a free service ticket for her use will be forwarded to her owner. If the service list of the stallion selected by the applicant is already full, the applicant will be so informed by the Secretary of the Committee, and advised as to the choice of another and suitable stallion.

9. The owner of a Premium stallion, or his representative, may refuse service by his stallion to any mare if the free service ticket presented on her behalf has any erasure or alteration on it, which has not been initialed by the Secretary of the County Committee, to whom reference should be made in the event of any dispute.

10. A County Committee may refuse to award a nomination for free service to a mare without assigning any reason therefor.

11. No person is entitled to receive a nomination for free service for more than one mare in any one season.

12. If the owner of a mare to which a free nomination has been awarded fails without sufficient cause to send such mare to the selected stallion, or neglects to avail himself of the right to a second or third service, where necessary, he may be debarred from receiving any future advantage under the Board's schemes.

A nomination for free service will be forfeited and lapse :—

(*a*) If the owner of the mare is also owner of the stallion selected;

(*b*) If the person to whom a nomination is issued permits his nominated mare to be served by a stallion other than that named on the service ticket;

(*c*) If the nominated mare is sold before service;

(*d*) If the nomination has been obtained through any misrepresentation.

Nominations for Service at Prescribed Fee.

13. The prescribed service fee of a King's Premium stallion is not to exceed £2, and that of a Board's Premium stallion £1, exclusive of a groom's fee of 2*s.* 6*d.* in each case, payable on the occasion of the first service.

14. Nomination tickets for the service of mares at a fee by a specified stallion will be issued by members of the District Committee concerned on application by their owners provided that payment of the prescribed service fee is made at the time of issue, or an undertaking given to pay the same. Receipts for payments of service fees are to be obtained and shown to the stallion owner on the occasion of the first service.

15. A stallion owner or his representative may refuse service by his stallion if payment for the same has not been made prior to or on the occasion of the first service.

Service without Nomination.

16. Mares can also be accepted for service if the owner of a stallion or his representative so agrees and arranges for the collection of the prescribed fees.

General Conditions.

17. Persons issuing nomination tickets (free or otherwise) are to inform the owner of the stallion of the names of the persons to whom they have issued them. The tickets are to be handed to the stallion owner on the occasion of the first service, and he is to give a receipt for them, and for any service fees paid direct to him.

18. A receipt from the stallion owner for the payment of the service fee or for a nomination ticket will on production to the stallion owner who issued it entitle the mare in respect of which it is issued to a second and third service, if necessary, should she come in use again on two future occasions during the season of service.

19. A service ticket is not transferable by the person to whom it is issued, and is available only for the mare for which it is issued and for the stallion mentioned thereon.

20. The trial of a mare is equivalent to a service, and the owner is liable for the payment of the fee.

21. A mare can only be served at the risk of her owner or his representative.

22. The owner of a stallion, or his representative, may require hobbles to be used for any mare served.

23. The owner of a stallion or his representative may refuse to allow his stallion to serve a mare suffering from a contagious disease, but he must immediately notify the reason for such refusal to the Board, and, in the case of a mare with a free service ticket or that of a leased mare, to the County Committee as well.

24. On completion of a first service the owners of the stallion and mare, or their representatives, are to sign and countersign respectively the service ticket in the service book of the stallion owner.

On completion of a second and third service the owner of the mare, or his representative, is to sign the service book of the stallion owner in the space provided on the counterfoil.

25. The owner of a mare who is detected in any malpractice either in connection with an application for a nomination or in contravention of these Regulations may, in addition to any penalty to which he may be liable by law, be debarred from obtaining any future benefits under the Board's schemes.

26. In all cases of dispute, the final decision rests with the Board.

Agricultural Classification in the Census of 1911.

The Board of Agriculture and Fisheries think it desirable to bring under the notice of agriculturists the following Memorandum which has been prepared by the Registrar-General with reference to the returns of the occupations of persons engaged in agriculture, which will be required for the purposes of the Census of the population of England and Wales, to be taken on April 2nd, 1911.

Memorandum by the Registrar-General.

The persons engaged on farms are intended to be shown in the Census of 1911, in the following groups:—

(1) Farmer, grazier.

(2) Farmer's son, daughter, or other relative, assisting in the work of the farm.

(3) Farm bailiff.

(4) Shepherd.

(5) (*a*) Agricultural labourer, farm servant, distinguished as in charge of horses.

(*b*) Agricultural labourer, farm servant, distinguished as in charge of cattle.

(*c*) Agricultural labourer, farm servant, not otherwise distinguished.

It is of the utmost importance that the Census should furnish an accurate return of the occupations of persons engaged on farms in England and Wales. This can only be secured if the column provided for the purpose in the Census Schedule (Column 10) be correctly filled up by the occupier of every separate house or tenement in terms which will ensure that all such persons may be subsequently grouped under one or other of the foregoing headings.

1.—Every occupier of land whose principal occupation is that of a *farmer* or *grazier,* should state this fact, employing one or other of these terms.

2.—*Sons* or other *relatives* (male and female) of farmers engaged in "assisting in the work of the farm" should so return their occupation.

3.—A person in charge of a farm on behalf of the owner or occupier should describe himself as "farm bailiff," or, if the term *farm foreman* or *farm steward* is used in these circumstances, it should be explained that it is employed in this sense.

4.—*Shepherds* are to include every person on the farm whose time is wholly or chiefly taken up with the care of sheep.

5.—The three sub-divisions under which *agricultural labourers* are now to be shown must include *farm labourers, farm servants* (not being domestic servants), and all other persons engaged in farm work, other than shepherds; and such persons are accordingly requested to indicate, by some distinctive term such as "carter on farm," "cattleman

on farm," whether their main employment is the working or tending of *horses*; or the tending or management of *cattle*; or whether their work on the farm is of a *general* character and does not permit of the distinction just suggested being drawn, in which case either the term "farm servant" or "agricultural labourer" should be used.

Where a term of local use is employed in filling up the Schedule, explanatory words of a simple and general character must be added to make it clear to which of the above groups the person using it belongs. Thus "*hinds*" should describe themselves as "hind (farm bailiff)"; "hind (farm foreman)"; "hind (in charge of horses)"; "hind (ordinary agricultural labourer)" according to the meaning of the term "hind" in the particular locality.

It is particularly important that the directions of instruction No. 8 on the Census Schedule should be followed, and where specific names such as "waggoner," "carter," "horsekeeper," "teamster," or "cattleman" are employed, they should be invariably followed by the words "on farm." Especially must care be taken not to use the term "labourer" alone, without the qualification *farm* labourer, or *agricultural* labourer, or labourer *on farm*, wherever the labour is in connection with any form of farm-work.

Other persons belonging to the agricultural class, such as gardeners, woodmen, and others following specific occupations, will be separately grouped under headings not referred to in this memorandum. Gardeners, however, engaged with nurserymen and seedsmen should always state the fact, so that they may be readily distinguished from gardeners in private employment; and it is also desirable that persons working on market gardens should clearly indicate that they are so employed.

In cases where a person no longer pursues his calling, but has retired from active work, the previous occupation should always be given, coupled with the word "retired."

In view of the importance at the present time of questions relating to the number and distribution of the agricultural population, the Board trust that all persons concerned will on this occasion render their best assistance to ensure that the particulars entered on the Census Schedules by farmers and farm labourers are precise and specific and capable of accurate arrangement in the groups to which they respectively belong.

Agricultural Statistics.

The Board have recently published the fourth part [Cd. 5469. Price 7*d*.] of the volume of Agricultural Statistics for the year 1909, which comprises summaries of the agricultural statistics of the British Possessions and of foreign countries, with certain particulars of the prices of agricultural commodities in those possessions and countries, so far as information is available.

The tabular information is prefaced by a Report by Mr. R. H. Rew, dealing with the changes in area under certain crops and in the live stock of different countries, and also with the world's harvest in 1909. Attention is also devoted to the potato and hop crop.

This part also contains an Index to the whole volume. The pre-

ceding parts were issued as follows:—Part I. [Cd. 5064. Price 5*d.*], containing the detailed returns of acreage and live stock in Great Britain, in March last; Part II. [Cd. 5095. Price 4½*d.*], containing returns of the production of farm crops in Great Britain, in April; and Part III. [Cd. 5268. Price 9*d.*], containing statistics of the prices and supplies of corn, live stock, and other agricultural commodities in Great Britain, in August.

These publications may be purchased (either directly or through a bookseller) from Wyman and Sons, Fetter Lane, E.C., and Oliver and Boyd, Edinburgh.

IMPORTATION REGULATIONS.

An Act of Congress approved August 5th, 1909, provides that no animal shall be imported free of duty unless pure-bred of a recognised breed and duly registered in the book of record established for that breed. It further provides that the certificate of such record and of the pedigree of such animal shall be produced to the customs officer, duly authenticated by the proper custodian of such book of record, together with the affidavit of the owner, agent, or importer that such animal is the identical animal described in the said certificate of record and pedigree.

Importation of Pedigree Stock for Breeding into the United States.

The United States Department of Agriculture have made the following regulations (B.A.I. Order 175), dated November 25th, 1910, taking effect as from January 1st, 1911:—

The Bureau of Animal Industry of the Department of Agriculture is authorised to issue certificates of pure breeding, and in order to obtain such certificates importers are to conform to the following procedure: An application for certificates is to be made to the Bureau of Animal Industry on forms approved by the Department, showing the number of animals to be imported, the breed and sex, the port of shipment, the port of entry into the United States, the name of vessel by which shipped, and the probable date of arrival. This application may be signed either by the owner, the importer, or the agent, stating the name and address (in the United States) of the owner of the animal or animals.

Certificates of registration and pedigree for said animal or animals, issued by the custodian of one of the books of record given in the order, are to be furnished to the Bureau of Animal Industry with the application.

A certificate from the seller or his agent is to be furnished to the Bureau of Animal Industry with the application, giving the name and registry number of each animal sold to the importer, the date of sale, the place of purchase, and the name and address (in the United States) of the purchaser. Vendor's certificates furnished by the custodians of foreign books of record, containing the above information, may be used; otherwise the form of vendor's certificate approved by the Department must be used.

When the application and accompanying papers are satisfactory, certificates to that effect will be issued and forwarded to the inspector of the Bureau of Animal Industry at the port of entry.

Where the provisions of the order have been otherwise complied with, animals will be certified as pure-bred which have been fully registered in good faith in one of the books of record for one of the recognised breeds given in the order, except those which have been registered on inspection.

Recognised Breeds.—The following British breeds of domestic animals had been certified to the Secretary of the Treasury at the date of the Order, the recognised herd or stud book of the breed being referred to in each case :—

Horses: Clydesdale, Hackney, Shetland Pony, Shire, Suffolk, Thoroughbred, Welsh Pony and Cob.

Cattle: Aberdeen-Angus, Alderney, Ayrshire, Devon, Galloway, Guernsey, Hereford, Highland, Jersey (Royal Jersey Agricultural Society's Herdbook and the Herdbook of the English Jersey Cattle Society), Kerry and Dexter (English Kerry and Dexter Cattle Society, and the Kerry and Dexter Herdbook of the Royal Dublin Society), Red Polled, Shorthorn, Sussex, Welsh Black.

Sheep: Cheviot, Cotswold, Dorset Horn, Hampshire Down, Kent or Romney Marsh, Leicester, Leicester (Border), Lincoln, Oxford Down, Shropshire, Southdown, Suffolk, Wensleydale.

Pigs: Berkshire, Tamworth, Yorkshire (Herdbook of the National Pig Breeders' Association).

Certain foreign books are also recognised, together with the Canadian National Records, in respect to certain specified breeds. Recognition of an additional breed is obtained by submission for approval to the United States Department of Agriculture of the whole of the published volumes of the book of record, together with all the rules in force relating to registration in the said book.

These Regulations supersede all previous Orders, and the effect is to withdraw the right of American and Canadian breeding societies to issue certificates for the free entry of registered animals.

By an Amendment (No. 1) to the Order, no animals registered in the Canadian National Records shall be certified by the Secretary of Agriculture as pure-bred except those which trace in all crosses to registered animals in the country where the breed originated.

Importation into France of Dodder and Forage Seeds containing Dodder.—With reference to the note given in this *Journal*, July, 1908, p. 303, as to the prohibition of the importation into France of dodder and forage seeds containing dodder, a French Customs Circular, issued in 1910, notified that forage seeds presented for importation in which the presence of dodder has been ascertained, may, without previous authorisation of the Minister of Agriculture, be freed from the parasite in warehouses at certain specified ports. A further Customs Circular, recently issued, provides that, in future, the waste resulting from sifting—which, besides the dodder seed, often contains a quantity of sound seeds—may, on application by the persons concerned, be re-exported instead of being burned, as was required heretofore. It is also notified that the duties on the seed freed from dodder may be levied on the weight of such seeds after being freed from the parasite in warehouse. (*Board of Trade Journal*, February 16th, 1910.)

Importation of Plants into the Uganda Protectorate.—Ordinance No. 1 of 1911, of January 11th last, empowers the Governor of the Protectorate to prohibit the importation of any plants, earth, packages, or other articles likely to introduce any plant disease into the Protectorate. Where, in the opinion of the Botanical Authority, disinfection is not sufficient to destroy any insect pest or fungoid disease on any plant sent for disinfection, such plant may be destroyed.—(*Board of Trade Journal,* February 23rd, 1911.)

Importation Regulations.

Importation into Russia, Free of Duty, of Preparations for Combating Plant Diseases.—The Board of Trade are in receipt, through the Foreign Office, of a copy of a despatch from H.M. Ambassador at St. Petersburg reporting that the lists issued by the Minister of Finance, of preparations for combating the diseases of the vine and fruit trees which are admitted free of duty in accordance with Note 2 to Tariff No. 112, as also the prescribed conditions governing their duty-free admission, are to remain in force unaltered.

The preparation for shrubs and trees called in Russian "caterpillar gum" will be admitted duty-free for Government and public institutions and for private individuals, upon presentation in every case of a special voucher from the Department of Agriculture or persons duly authorised by that Department. Institutions and individuals receiving this "caterpillar gum" duty-free will be held responsible for the use of the preparation exclusively in connection with arboriculture and fruit-growing.—(*Board of Trade Journal,* February 23rd, 1911.)

MISCELLANEOUS NOTES.

Agricultural Machinery in Argentina.—The Board of Trade have received the following note from H.M. Consul at Buenos Aires (Mr. A. C. Ross, C.B.):—

Demand for Agricultural Machinery.

In 1908, the latest year for which the particulars are available, the imports of agricultural machinery into Argentina from the United Kingdom, of which the greater part consisted of thrashing machines, were valued at only some £250,000, while the value of the imports from the United States was about £650,000. As regards thrashing machinery, it is probable that the orders for these will be diverted in the future to the United States. Several North American manufacturers of thrashers have now established depôts at Buenos Aires, where they have their own representatives, workmen, and warehouses, while not one British maker has an establishment of his own in the country. It is to be noted that many small machines for crushing grain and chopping hay, roots, &c., are imported. (*Board of Trade Journal,* February 2nd, 1911.)

Competition of Agricultural Motors at Winnipeg.—The Commercial Intelligence Branch of the Board of Trade is notified that at the annual International Industrial Exhibition at Winnipeg this year there will be held, from 5th to 22nd July, an international agricultural motor competition. Applications for admission to this competition will be received by the Exhibition authorities

Agricultural Exhibitions Abroad.

at Winnipeg up to June 1st. A copy of the rules and regulations may be seen at the above branch of the Board of Trade.

Agricultural Exhibition at Odessa.—The Imperial Russian Technical Association intend to hold an exhibition at Odessa from May to October during the present year, which will include sections devoted to the various branches of agriculture. Foreign exhibits will be admitted, will be allowed into Russia free of import duties, and will receive favoured treatment in regard to transport rates on Russian railways. Applications for space must be sent in not later than March 28th, and exhibits will be admitted from April 14th to May 14th.—(*Board of Trade Journal,* February 23rd, 1911.)

Live Stock Shows at the Turin Exhibition.—The Board of Agriculture and Fisheries desire to give notice that an International Show of Cattle and Sheep will be held in Turin from the 12th to the 20th June next in connection with the International Exhibition.

There will be classes open to British cattle and sheep; the awards in these classes include 235 medals or diplomas of medals and cash prizes amounting to £860. There will also be a Championship Prize and a Grand Prize of Honour.

An International Poultry and Rabbit Show will be held from the 4th to the 7th May.

Further particulars may be obtained from the Secretary to the Agricultural Committee of the Royal Commission for the Exhibition, Winchester House, St. James's Square, London, S.W.

Notes on Agriculture Abroad.

Potash Production in Germany.—In continuation of the note on the potash production of Germany which appeared in this *Journal* for December, 1910, p. 768, the following information, given in *U.S. Daily Consular and Trade Reports,* January 26th, 1911, may be of interest.

It is announced that the Bundesrat has considerably increased the quantity of potash which can be produced by German potash works during the period from May 1st to December 31st, 1911. Compared with the amounts as determined in June, 1910, the amounts of pure potash (K_2O) which can be sold during the period without being subjected to the special tax, are now fixed as follows:—

	Old allowance. Tons.	New allowance Tons.
For Home Consumption	201,000	216,000
For Exportation	195,000	278,000
Total	396,000	494,000

The increased production will, therefore, amount to about 98,000 tons. The share of the output falling to the different factories from January 1st, 1911, is also given in this Report.

Sheep-Raising in Russia.—Mention was made in this *Journal* for December, 1910, of the decline in wool production in European Russia which has taken place during the past few years. A special committee on this subject, appointed by the Russian Department of Agriculture, has decided to open an exhibition of sheep-raising on May 14th, 1911, at Moscow, and to hold a convention of wool-growers at the same time. A Report showing the crisis through which the Russian sheep-

raiser is passing was presented to the committee, and it is suggested that the only means of restoring this industry to its former extent are the utilisation of those portions of the Siberian steppes not otherwise fit for agricultural development. Sheep-breeding on correct and modern methods is advocated, and organisation for an increased production of mutton for the markets. By raising cross-breds which produce a wool closely resembling that grown by the foreign cross-breds, and a mutton satisfying the demands of the market, sheep-breeding would be made more profitable. The conditions for feeding and maintaining the sheep during winter in the districts in question are satisfactory. (*U.S. Daily Consular and Trade Reports,* January 16th, 1911.)

Hop Production in Bohemia.—On the basis of estimates obtained from several sources, the United States Consul at Prague places the production at 258,000 cwt., out of a total of 341,000 cwt. for Austria-Hungary. The Bohemian crop has been very satisfactory, though, owing to the wet weather, the Saaz crop was not quite so bright in colour as was desired, but the quality of the hops was very good. The total production of Austria-Hungary will, according to the above estimate, be very little below the record yield of 1908, and almost double the 1909 crop. The prices for the 1910 crop in Bohemia have averaged about the following:—Saaz, 11½*d.* per lb; Auscha, 10½*d.* per lb.; and Dauba, 8*d.* per lb., or about one-half the price realised for the crop of 1909. (*U.S. Daily Consular and Trade Reports,* January 17th, 1911.)

Progress of Agriculture in Adana, Turkey.—Request for Seed Catalogues.—The Board have received, through a correspondent, a letter from Mr. A. G. Adjemian, Director of Agriculture in the Province of Adana, Turkey, in which he states that considerable progress has been made during the past few years in the condition of agriculture in Adana. Agricultural machinery is being much used. An agricultural college is being built, and some £6,000 have been granted by the Government towards the cost. Some experiments have been begun, and the Director of Agriculture will be pleased to receive catalogues from seed growers in England, with a view to the introduction of new seed.

Live Stock in Canada.—The Canadian *Census and Statistics Monthly* for January, 1911, gives the number and value of the live stock in the Dominion of Canada in 1910 as follows:—

	Number.	Value (£).
Horses	2,213,199	61,125,000
Milch cows	2,853,951	25,336,000
Other cattle	4,260,963	27,454,000
Sheep	2,598,470	3,296,000
Swine	2,753,964	6,491,000

Butter, Egg, and Poultry Trade of Russia.—The Board have received from H.M. Consul-General at Odessa a summary of articles recently published in the *Torgovo-Promyshlennaya Gazette,* on the subject of the growing export from Russia of butter, eggs, and poultry.

Soon after the opening of the Russian Trans-Siberian railroad, Siberia began to supply dairy farming produce, principally butter. In

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this way attention was drawn to the vast possibilities of Russia in this direction, but though dairy farming is prosperous and rapidly growing, it is surpassed by what might be regarded as a minor industry of small importance, viz., by poultry farming.

During the eleven years from 1899 to 1909 the exports of butter (the produce of Siberia and of northern Russia) increased from 10,200 tons, worth £745,000, to 52,800 tons, valued at £5,109,000. The active competition of Siberia has not depressed the manufacture of butter in the European parts of Russia, but has rather stimulated it. In most parts dairy farming is increasing in importance, the cultivation of grass for hay is being developed, arable land being more largely used for clover and timothy. The chief progress has been in the thinly populated northern and eastern parts of Russia.

Poultry farming, on the other hand, has made the greatest progress in the more thickly populated parts, and the export of eggs has increased from 1,686 millions, valued at £3,023,000 in 1899, to 2,845 millions, worth £6,566,000 in 1909. The increase in value is far greater than in quantity, and it is ascribed rather to the improved quality of the produce than to the general rise in food prices, though doubtless the latter is partly responsible.

Besides eggs there is a considerable export of dead fowls, the value of which rose from £834,000 to £1,509,000. In addition, feathers and down of the value of £190,000 are exported, so that the value of all poultry products amounts to £8,265,831, as against £3,857,008 in the year 1899. In spite of the increasing export and of the rising prices of poultry products, the consumption within the country increases, not only among well-to-do customers, but also among the producing peasant farmers themselves.

In many places it is thought possible that, as the land is more and more subdivided into small holdings, poultry farming may supersede the cattle industry.

Information supplementing the above as regards the development of the dairying industry in Siberia is given in *U.S. Daily Consular and Trade Reports,* December 29th, 1910. It is stated that the Siberian cattle are of better quality than the average Russian stock, and the pastures are also of a higher quality and more generally watered, so that the butter from that region is in favour in Europe and England, the demand so far being greater than the actual supply. Siberian cheese finds a ready market at home, but the better grades are found throughout Europe.

The creameries are conducted by organisations known as "artels." If the dairies are situated near the creameries, the milk is purchased from the farmer, but if the farm is at some distance the cream is purchased. Many farmers churn their milk and sell the butter to the creameries, where it is rewashed, tested, graded as to colour and other constituents, grouped, packed, and shipped to the market centres for distribution. According to the latest figures available, there are 1,868 butter factories in Siberia, and their reports for 1910 are stated to show that the average yield is 1 lb. of butter to 20 lb. of milk. Milk costs, wholesale at the creameries, 4*d.* a gallon. The highest price obtained by the manufacturers for butter was 9½*d.* per lb., and the lowest 8½*d.* per lb. About 30 per cent. of the butter factories are managed by

"artels," and of 379 associations reporting there were 49,176 members who owned 258,551 cows, giving an average of five cows per member. It is expected that this development of the dairying industry will be accompanied by a corresponding demand for dairy machinery, chiefly separators. In 1908 the bulk of the imports of such machinery came from Sweden. The exhibition at Omsk, from June 15th to August 1st, 1911, will include dairying and dairy machinery.

Butter production is also being rapidly developed in Finland under the auspices of the provincial Governments.

Changes in the World's Stock of Cattle, Sheep, and Swine.

The International Agricultural Institute has issued, in its February Bulletin of Statistics, a statement showing the changes in the number of cattle, sheep, and swine which have occurred between 1900 and 1910 in many of the principal countries of the world. Where figures for these years were not available, those for the nearest year have been taken.

Cattle.—The tables show that the total number of cattle in the group of countries considered has increased from 280,676,000 in 1900 to 330,190,000 in 1910. The number per 1,000 inhabitants has also increased, the population having increased by 13·1 per cent. and the cattle by 17·6 per cent.

It is interesting to note that, though the total number of cattle in Europe has increased, the number per thousand has decreased; for while the population has increased by 13·2 per cent. the number of cattle has only increased by 4·4 per cent. In America and in Australasia the proportionate increase in cattle has been greater than that of the population.

Sheep.—In the group of countries for which particulars relating to sheep are available, the total number has increased from 419,386,000 to 455,168,000, but the number per 1,000 inhabitants has decreased, the population having increased by 13·2 per cent. and the number of sheep by 8·5 per cent. In Europe not only has the number of sheep per 1,000 inhabitants decreased but also the total number.

Swine.—The total number of swine in the group of countries for which particulars are given has increased from 96,313,000 to 115,430,000, and the number per 1,000 inhabitants has also increased, the population having increased by 14·0 per cent. and the number of swine by 19·8 per cent.

It is interesting to note that though the total number of swine in Europe has increased, the number per 1,000 inhabitants has slightly decreased, the population having increased by 13·2 per cent. while the number of swine has increased only by 12·9 per cent.

In America the proportionate increase in the number of swine is greater than that of the population, and in Australasia less.

It is remarked in the Bulletin that when examining these figures it should be borne in mind that the breed of the animals is almost everywhere continually improving, so that a given number of live stock to-day represents, in all probability, a larger quantity of meat than the same number of animals ten years ago.

Agricultural Conditions in Great Britain on March 1st.

The Crop Reporters of the Board, in reporting on agricultural conditions in February, state generally that the open weather, especially during the first half of the month, has, on the whole, favoured the autumn-sown crops, and the appearance of the wheat shows improvement. Early sown wheat, as has been the case throughout the season, looks better than the late sown, which still looks thin in places, while some resowing has taken place upon lands flooded during December. The storms in the west and north during the latter part of the month, which were most severely felt in Scotland, do not appear to have done any material harm.

During the first part of the month considerable progress was made with the spring sowings, and in most districts farm work is more forward than usual. In many districts of England most of the spring wheat had been put in, the north-eastern division being apparently the most backward, relatively, in this respect. In the east and south, considerable progress had been made with oats and beans, the seed being generally reported to have gone into an excellent seed-bed. Where showing above ground, the appearance of the young crops was quite satisfactory. Much less barley had, at the date of the reports, been sown, while in only a few places (except in the south-east) had a beginning been made with peas. Very little spring-sowing had been done in the more northern districts of England or in Scotland.

The reports on lambing are somewhat variable, and, on the whole, the fall of lambs would hardly appear to be more than average. Lambing is practically finished in a few southern counties, and is now general over the midland counties of England. There are fewer unsatisfactory accounts from the latter than from the south, where reports of heavy losses among the ewes or the lambs are not infrequent. In the north, where lambing has not yet commenced, the ewes are reported generally to be in very good condition, though in the west of Scotland they have suffered badly in some districts from the rough weather.

Live stock generally are reported to have done well during the month, and to be in good condition, with some exceptions in a few localities.

Notes on the Weather in February.

The weather during the *first* week (January 29th to February 4th) was fair or fine over Great Britain generally, but mist or fog prevailed at times in most districts. Except in Scotland N., temperature was below the average, the deficiency being large as a rule. No rain fell in England N.W. and S.W., and Scotland E., and in other parts of the country the fall was very slight. Bright sunshine exceeded the normal in all districts except Scotland W., the excess being considerable in many localities.

Though the general condition during the *second* week was cloudy or overcast, rainfall continued either "light" or "very light," and only in England E. was it classed as "moderate." At many stations the

fall was less than 0·1 inch, and at Balmoral, Bawtry, and Llandudno there was none. Temperature was below the average in all districts except Scotland N., and bright sunshine was "scanty" or "very scanty."

During the *third* week the conditions varied greatly in different parts of the country. In the extreme west and north rain fell daily, and was generally heavy, while further to the eastward and southward the rain was slight and less frequent, and in the Midlands and east of England the greater part of the week was fair and dry. Temperature was much above the normal, being classed as "unusual" or "very unusual" everywhere. Bright sunshine was below the normal generally, just equal to it in the Midland Counties and above it in England E. and S.E.

The weather in the *fourth* week continued very changeable. Warmth was "unusual" over the country, the excess over the normal being 6° in England E. Rainfall was "heavy" or "very heavy" with the exception of moderate falls in England N.E. and S.E. An abundant amount of sunshine was experienced in all districts except Scotland N.

According to the Annual Summary for 1910, issued by the Meteorological Office, the aggregate amount of rainfall during the year ranged from 134·3 inches at Seathwaite (Lancs) to 20·6 inches at Spurn Head. As a rule, the frequency of precipitation was considerably in excess of the normal, rain being measured on more than 200 days at the great majority of stations. There were very few maximum temperatures of 80° and above during the year. The coldest period was January 26th to 28th, when temperature fell below 20° at the majority of stations, and −10° was recorded at Balmoral. The diminution in the frequency and intensity of inland fog, so noticeable in recent years, was maintained in 1910.

Notes on Crop Prospects Abroad.

The International Institute of Agriculture has published, in its Bulletin of Agricultural Statistics for February, 1911, the following information with regard to the area sown in the autumn of 1910 with winter cereals:—

Country.	Winter Wheat.		Winter Rye.		Winter Barley.		Winter Oats.	
	Area sown in 1910.	Compared with 1909.	Area sown in 1910.	Compared with 1909.	Area sown in 1910.	Compared with 1909.	Area sown in 1910.	Compared with 1909.
	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.
Belgium ...	393,000	101·0	622,000	98·0	74,000	100·0	—	—
Bulgaria ...	—	101·0	—	101·0	—	101·0	—	—
Denmark ...	104,000	103·0	679,000	99·6	—	—	—	—
Spain	9,610,000	101·5	2,232,000	108·5	3,645,000	107·1	1,045,000	81·5
France... ...	13,910,000	90·0	2,893,000	96·5	352,000	95·5	1,843,000	93·0
Great Britain...	—	107·0	—	—	—	—	—	—
Luxemburg ...	27,000	99·0	26,000	101·0	—	—	—	—
Roumania ...	4,826,000	101·0	316,000	84·0	126,000	68	—	—
Canada ...	790,000	100·3	—	—	—	—	—	—
United States .	34,472 000	102·5	2,137,000	98·8	—	—	—	—
British India ...	23,412,000	103·0	—	—	—	—	—	—
Japan	1,132,000	101·0	—	—	3,050,000	99·0	—	—

Later figures are also given in the Bulletin of the cereal production in Australia and New Zealand in 1910–11, and should be substituted

for those which appeared in this JOURNAL for last month, p. 951. The production of wheat in Australia in 1910–11 is now reported as 48,209,000 cwt., and the production in New Zealand of cereals in 1910–11 as follows:—Wheat, 3,904,000 cwt.; barley, 386,000 cwt.; oats, 4,469,000 cwt.; maize, 234,000 cwt.

Argentina.—The official estimates issued by the Department of Agriculture of the yield of wheat, linseed, and oats for 1910–11 as compared with 1909–10 are as follows:—

	Wheat. Tons.	Linseed. Tons.	Oats. Tons.
1910–11	3,650,000	674,000	581,000
1909–10	3,508,000	705,000	521,000

It is expected that the quantities available for export in 1911 will be:—Wheat, 2,200,000 to 2,300,000 tons; linseed, 600,000 tons.—(*Review of the River Plate,* December 30th, 1910.)

According to a report, dated February 1st, furnished by the British Minister at Buenos Aires, the maize harvest has been adversely affected by the drought. Some rain has fallen, but at the time of this report there was reason to believe that there would be barely more than sufficient maize for home consumption.

Roumania.—The following particulars of the area and yield of certain grain crops in Roumania in 1910, as compared with 1909 and the average of the five years 1905–9, are taken from the *Monitor Oficial* of January 26th and February 8th, 1911 (*Board of Trade Journal,* February 23rd, 1911):—

	Average 1905–9.		1909.		1910.	
	Area.	Yield.	Area.	Yield.	Area.	Yield.
	Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.
Wheat	4,538,000	71,906,000	4,172,000	54,997,000	4,812,000	107,337,000
Barley	1,367,000	21,865,000	1,356,000	19,339,000	1,357,000	28,451,000
Oats ..	1,028,000	20,571,000	1,197,000	25,143,000	1,103,000	28,731,000
Maize.	5,004,000	76,835,000	5,245,000	67,970,000	4,906,000	100,461,000

The *Monitor Oficial* of February 8th gives, in addition, the area sown in the autumn of 1910 as follows:—Wheat, 4,840,000 acres; rye, 321,000 acres; barley, 124,000 acres. The corresponding areas in 1909 were:—Wheat, 4,766,000 acres; rye, 378,000 acres; barley, 186,000 acres.

Irish Agricultural Labourers in England and Scotland.

A report issued by the Department of Agriculture and Technical Instruction for Ireland deals with the annual migration of agricultural labourers to England and Scotland, and the work and earnings of such migratory labourers.

The number of Irish agricultural labourers who went to and returned from England and Scotland in 1909 is estimated at about 20,500. The great majority of the migratory labourers come from Connaught, and within that province County Mayo has always been the principal source of these labourers. Ulster is the only other province from which there is any

large movement of migratory labourers, and of these nearly 85 per cent. are from Donegal.

The migratory labourers fall into three distinct groups:—(1) Achill workers, both male and female, employed chiefly in raising potatoes in Ayrshire and neighbouring counties of Scotland; (2) Donegal men, who go chiefly to the East and South-East of Scotland, and also to Northumberland, and are employed chiefly in turnip-singling, hay-making, corn harvest, potato and turnip raising; (3) Connaught men, who go to England, mainly to Cheshire, Lancashire, Durham, Yorkshire, Lincolnshire, Cambridge, Huntingdon, Warwick, and Stafford, and are employed on similar work to the Donegal men.

The Achill workers come over largely in families or groups, and are organised in squads. The total number seems to be comparatively stationary, and to range from 1,500 to 2,000. The wages of the average worker—other than those who are in charge of squads—are usually close on 15*s*. a week, and it is stated that workers usually save from £8 to £10 in the season, which lasts from early in June to the end of October or the beginning of November. The wages earned by the Donegal men range from 3*s*. to 4*s*. per day (or more when on piece work), with free lodging and coals; many of them save from £10 to £15 and up to £20 in the season (June to November, or later). The Connaught men begin to come over in considerable numbers from the middle of March onwards, though the great exodus is in June, and they remain in England until November, and in some cases up to Christmas. Their wages, if by the week, run as a rule from 15*s*. to 20*s*., with lodging, fuel, and occasionally some food: to a large extent, however, work is paid by the piece, and earnings vary from 18*s*. to 30*s*. (or even more) per week.

Agricultural Labour in England during February.

The Board of Agriculture and Fisheries have been furnished by the Board of Trade with the following report, based on returns from correspondents in various districts, on the demand for agricultural labour in February:—

Employment was generally fairly good during February, the fine weather which prevailed during the greater part of the month enabling farmers to offer a fair amount of employment to men outside the ordinary farm staff on such work as threshing, carting manure, hedging, and ditching. There was generally an ample supply of such extra men, but mention of any marked surplus was exceptional in the reports. Men for permanent situations were again reported as scarce in certain parts of the Midland and Southern and South-Western Counties.

Northern Counties.—Agricultural employment was generally regular in these counties, except in the Western districts, where stormy weather during the last half of the month caused loss of time to extra labourers. There was a moderate demand for extra men for hedging, ditching, threshing, &c., in *Yorkshire*, but the supply was in excess of the demand in the Bridlington, Driffield, Howden, Shirburn, and Wortley rural districts; in the other counties but few of these men were required at any period during the month. Little or no change was reported in wages at the Candlemas hiring fairs in Cumberland.

Midland Counties.—For the time of the year there was a fairly good

demand for extra men in these counties, the weather being exceptionally fine. The demand was chiefly on account of carting and spreading manure, threshing, hedging, ditching, and cutting wood. It was more than met by the supply in *Oxfordshire,* but in the other counties the supply and demand were generally fairly well balanced. A demand for men for permanent situations was reported from several districts in *Worcestershire* and *Hertfordshire.*

Eastern Counties.—Threshing operations were somewhat hindered at times by wind and rain, but, apart from this, employment generally suffered little interruption from the weather, and farm work was reported to be in a fairly forward state at the end of the month. Hedging, ditching, carting manure, besides threshing, provided work for extra men, and the supply of such men was usually taken up by the demand. A scarcity of single men and milkers was reported in the Brigg rural district in *Lincolnshire.*

Southern and South-Western Counties.—With the exception of two or three days at the end of the month, outdoor work suffered little or no interruption in these counties, and extra men had a fair amount of employment at such seasonal operations as threshing, carting manure, and hedging. The supply of and demand for these men were generally about equal, an excess being reported only in the Epsom (*Surrey*) and the Devizes (*Wiltshire*) rural districts. An excess of men for permanent situations was reported in the Wareham and Purbeck (*Dorset*) rural district; while there was a scarcity of such men in the Godstone (*Surrey*) and the Petworth and Uckfield (*Sussex*) rural districts, in the Aldershot district in *Hampshire,* and in the Wantage (*Berkshire*), Stow-on-the-Wold and Thornbury (*Gloucestershire*), Torrington (*Devon*), and West Penwith (*Cornwall*) rural districts.

THE CORN MARKETS IN FEBRUARY.

C. KAINS-JACKSON.

Wheat.—A high temperature for the time of year marked the whole course of February, and the last few days being wet as well as mild were against condition no less than demand. Prices ruling at the end of the month were 29*s.* to 33*s.* for English red wheat, 31*s.* to 35*s.* for fine white, 30*s.* to 32*s.* for Essex Rivetts. The latter, *Triticum turgidum,* is a coarse, strong red sort, and has latterly been in greater request than supply.

For imported wheat the inquiry all through the month was best for red; white sorts sometimes fell as much as eighteenpence per quarter for cargoes to arrive in March. The spot fall on the month may be averaged at a shilling on white and sixpence on red. Argentine, Canadian, American, and fine Russian types were held with fair confidence, while Californian, Australian, Indian, and inferior Russian were pressed on sale.

Shipments for February were 390,000 qrs. from North America, 1,250,000 qrs. from South America, 1,334,000 qrs. from Russia, 432,000 qrs. from Europe S.E., 291,000 qrs. from India, and 980,000 qrs. from Australia. The last-named figure exceeded expectation. Supplies on passage rose from 2,100,000 to 2,900,000 qrs., and from being 400,000 qrs. below the average, ended in exceeding it by a like amount. This fact of itself will account for a good deal of depression. Supplies of British wheat and of imported breadstuffs for the first half of the

cereal year ended February 28th were commonly regarded as no more than equal to the requirements of an average season.

Flour.—A material increase in the inquiry for medium rough grists is the chief event in this trade. An eighty per cent. formula, which is about midway between the finest roller flour and coarse brown bread flour, has found considerable favour with the public, and has enabled millers to place large quantities of such flour at 22*s.* to 24*s.* per sack. In the value of top-price flour there has not been any material change, but Town Whites and Town Households gave way on the 20th sixpence per sack, and country makes followed the London kinds at the next market.

The price of American and Canadian fell sixpence between the 13th and the 27th, but the supply on passage is so small and offers for March shipment are so limited that the month closed with several important firms holding for full prices. Australian flour has sold badly, and is a shilling cheaper on the month. North America in February shipped only 360,000 sacks.

Barley.—Canterbury on the 25th quoted an average of 28*s.* 10*d.* and Maidstone 31*s.* 6*d.*, but most of the statute markets have hardly reached 25*s.*; 24*s.* was the London mean for the week ended 21st, and in the course of the following days Berwick, Cambridge, and Reading ranged between 24*s.* and 25*s.* The demand for fine quality for seed varies greatly with different markets at this period of the year. At Mark Lane full average sowings for February were spoken of, but there was little bought off stands; farmers of means depend more and more on the seed merchants, who do business mainly by catalogue or through travellers. The others select as well as they can for themselves from their own or locally grown grain. This, at least, is what is commonly alleged by those who complain that Mark Lane is no longer the high quality barley market that it used to be.

Russian feeding barley has been in fair but not large supply, and the demand for barley meal, mainly for pig feeding, being good, prices have kept at 20*s.* 6*d.* to 21*s.* per 400 lb. Shipments for February were 837,000 qrs. from Russia, and 370,000 qrs. from Roumania, Bulgaria, and Salonica. There were some minor shipments of Ouchak from Smyrna. The supply on passage fell on the month from 690,000 qrs. to 685,000 qrs., a change of no market moment. Imports for the first half of the cereal year have been rather less than usual, while sales of home-grown have been rather liberal. The net position of the trade as a whole approaches very closely to the normal.

Oats.—A fair average for British has been made in London, but many of the country markets have been exceedingly depressed. A large area, for February, was said by frequenters of Mark Lane on the 27th to have been sown to oats in the Home Counties and East Anglia. Good heavy oats fetched at that market a full guinea for horse feed, and more if of named sort for seed. Six months' sales at the country markets—September 1st to February 28th—were very much the same as for the like period of last cereal year. Imports have been decidedly small. There were on the 28th, however, 840,000 qrs.—a record quantity—on passage, and the surpluses of Russia and Argentina are being pressed on the market at the very low price of 13*s.* to 13*s.* 6*d.* per quarter. February shipments were 897,000 qrs. from Russia and 661,000 qrs. from South America.

Maize.—The maize imports for the first half of the cereal year approached five and a half million quarters, and were nearly three-quarters of a million more than in the like period of the previous twelve-month. Prices underwent little change during February, 21*s*. for flat, 22*s*. for round, 23*s*. for white, and 24*s*. for yellow per qr. being the average currencies with which Mark Lane closed. Liverpool holders on the 28th obtained 4*s*. 2*d*. per cental for newly arrived American. There were on that day 495,000 qrs. on passage, a somewhat marked decline from the 1st, and as such indicating that the month's shipments for British ports had been smaller than the arrivals thereat. Shipments for February were 1,125,000 qrs. from North America, 68,000 qrs. from South America, 284,000 qrs. from Russia, 249,000 qrs. from Europe, S.E., and 30,000 qrs. from South Africa. The Continent was a freer buyer than usual.

Oilseeds.—An excited market from the 13th to the 24th caused linseed to reach 82*s*. for English and Bombay, 80*s*. for Calcutta and Russian, 78*s*. for La Plata. About 3*s*. was lost off these striking quotations by the 28th, but the month closed with exceptional figures, and the quantity on passage, 48,000 qrs., being much less than an average, stringency in the matter of supply appears inevitable for some time to come. India is reported to have a good crop in prospect, but supplies will hardly be here in bulk before June. The price asked is high, and India appears to have little fear of Argentine competition. During February La Plata shipped 286,000 qrs., against 779,000 qrs. in February, 1910.

Cottonseed did not share in the rise as Egypt has a large crop. About 8*s*. 6*d*. per cwt. has remained the ordinary selling value. The scarcity of linseed has stimulated sales of other oilseeds; sellers quote good rapeseed at 12*s*. 6*d*. per cwt. for English, 10*s*. 6*d*. Indian; sesame at 14*s*., and sunflowerseed at 17*s*. per cwt.

Various.—Beet sugar and feeding rice were a little dearer at the close of the month, while tares, canaryseed, Lucerne seed, and good white cloverseed showed a decided appreciation. On the other hand, English red cloverseed, Burmese haricot beans, and most of the by-products of the mill were cheaper. The dearness of oilcake has helped the demand for beans and peas, but the deliveries have been fairly free and farmers have been content to effect good clearances at January's full rates.

THE LIVE AND DEAD MEAT TRADE IN FEBRUARY

A. T. MATTHEWS.

Fat Cattle.—The chief feature of the cattle trade in February was its remarkable steadiness, at any rate, in the average values in the English markets. There were, of course, fluctuations in values at many centres, but these almost exactly balanced each other week by week. The range of prices, however, between different markets was very considerable, amounting to about 1*s*. per stone. It will be seen by the following that Shorthorns maintained the January prices, as also did Welsh Runts, while the other three breeds showed a slight decline. This was probably owing to the fact that over wide areas Shorthorns are in the height of their season for stall feeding. The average prices work

out as follows:—Shorthorns, 8*s.*, 7*s.* 3¼*d.*, and 6*s.* 4*d.* per 14 lb. stone, against 8*s.*, 7*s.* 3½*d.*, and 6*s.* 4*d.* in January; Herefords, 8*s.* 0¾*d.* and 7*s.* 6¼*d.*, against 8*s.* 2¼*d.* and 7*s.* 6*d.*; Devons, 8*s.* 0¾*d.* and 7*s.* 4½*d.*, against 8*s.* 3*d.* and 7*s.* 7*d.*; Welsh Runts, 7*s.* 11¼*d.* and 7*s.* 3*d.*, against 7*s.* 10¾*d.* and 7*s.* 4¼*d.*; Polled Scots, 8*s.* 1*d.* and 7*s.* 7½*d.*, against 8*s.* 2¼*d.* and 7*s.* 9*d.* per stone. London quotations for Shorthorns were again high in proportion to other markets, owing to the superior finish of the Norfolk supplies. These have weighed remarkably well, the excess of dead-weight over the live often amounting to several stones. Bristol has been about the cheapest market, but the great markets in the north, such as Leeds, Salford, and Liverpool, have also been relatively low. British beef has now returned to the level of values prevailing before the advance which set in about a year ago. In February, 1910, prices were something like ¼*d.* per lb. higher than they are at the present time.

Veal Calves.—There has been a very good demand for prime veal calves, which were scarce and rather dear. Second and third qualities were comparatively plentiful and relatively low in price. The averages in about twenty-three British markets were 9*d.* and 7¾*d.* per lb. for first and second qualities.

Fat Sheep.—The February business in fat sheep may be described as quiet but steady. There was a fractional advance in the average for "Downs," but it did not quite amount to ¼*d.* per lb. for first quality. This was secured on second quality, and also in those classed as Longwools. Wool is not selling quite so well as it did, and at this time of year that fact somewhat affects the prices of sheep. It is important to remember that the numbers of those which are classed as first quality are comparatively small, and that in those markets quoting 9*d.* per lb. it is but few that make it. A very much larger proportion of the tegs now coming to market, though equal as regards quality of their meat, have to be classed as second quality solely on account of their weight, and these form the bulk of the supplies. To speak, therefore, of English mutton making anything like 9*d.* per lb. at the present time would be misleading. The general averages in English markets for the month were 8½*d.*, 7¾*d.*, and 6*d.* per lb. for Downs, and 8¼*d.*, 7¼*d.*, and 5½*d.* for Longwools. Prime cross-breds in ten Scottish leading markets have averaged 9*d.* per lb. These small but popular sheep have also realised very high prices in northern markets like Salford, Carlisle, Preston, &c. Fat lambs are fetching up to 1*s.* 3*d.* per lb.

Fat Pigs.—During the latter half of the month there was a hardening tendency in the trade for bacon pigs, but the general average prices of 7*s.* 2*d.* and 6*s.* 6*d.* per stone were very slightly below those of January.

Carcass Beef—British.—London Central Market was fairly supplied with Scottish beef, which met a very quiet trade at prices fractionally below those of January. Short sides averaged 6½*d.* and 6¼*d.* for first and second quality; long sides, 6*d.* and 5¾*d.*, and English, 5¾*d.* and 5⅝*d.* per lb.

Port-Killed Beef.—The supplies of Deptford-killed in Smithfield Market were again small, and the prices realised are curiously on a par with those of English beef. The average prices of first and second

quality were $5\frac{5}{8}d.$ and $5\frac{3}{8}d.$ per lb. There was, however, a certain quantity of inferior beef at lower rates.

Chilled Beef.—This important section of our beef supplies was abundantly in evidence, and prices were lower than in January. Average London prices were:—Hindquarters, $4\frac{1}{8}d.$ and $3\frac{5}{8}d.$, and forequarters, $3\frac{1}{8}d.$ and $3d.$ per lb. for first and second quality. United States chilled was in small compass, and some leading firms are ceasing to import it. Prices were much higher than those of Argentine, and averaged $6\frac{1}{8}d.$ and $5\frac{5}{8}d.$ for hind, and $4\frac{1}{4}d.$ and $4d.$ for forequarters.

Frozen Beef.—Transactions in frozen beef were very limited owing to the low price of chilled. Quotations were almost nominal at $3\frac{1}{2}d.$ per lb. for hindquarters and $3d.$ for fores.

Carcass Mutton—Fresh Killed.—Supplies of small Scotch tegs decreased, and their average price advanced $\frac{1}{4}d.$ per lb. Prime sheep weighing 64 lb. were no dearer, and while the former realised $7\frac{7}{8}d.$, the latter only fetched $7d.$ per lb. Good West Country English tegs sold at $6\frac{5}{8}d.$ and $6\frac{1}{8}d.$ per lb. as the average prices, a slight decline on January prices. As much as $9d.$ per lb. was occasionally given for Scotch tegs, the legs of which weigh about $4\frac{1}{2}$ lb.

Frozen Mutton.—New Zealand mutton averaged $4\frac{3}{8}d.$ *and* $3\frac{7}{8}d.$ per lb. for first and second quality, and Argentine and Australian about $1d.$ per lb. less money, values tending slightly downward.

Carcass Lamb.—The British lamb on the London market has been limited as to quantity, and is as yet hardly of first-rate quality. It has been fetching $10\frac{1}{2}d.$ to $11d.$ per lb. New season Canterbury sold well at $6\frac{1}{4}d.$ per lb. till the end of the month, when it fell $\frac{1}{2}d.$ per lb. Second quality New Zealand made about $5\frac{1}{4}d.$ and Argentine $3\frac{3}{4}d.$ to $4\frac{1}{2}d.$ per lb.

Veal.—Prime veal has been making as much as $8\frac{1}{2}d.$ per lb. for English and $8d.$ for Dutch, the supply being limited, but middling and inferior have had to be sacrificed at very low prices.

Pork.—The trade at first was fairly good, and British pork sold readily at $6\frac{3}{4}d.$ to $7\frac{1}{4}d.$ per lb., but later considerable dullness set in and prices gave way fully $\frac{1}{4}d.$ per lb.

THE PROVISION TRADE IN FEBRUARY.

HEDLEY STEVENS.

Bacon.—The consumption of imported bacon in the month of February is generally slow, chiefly in consequence of freer offerings of the home-cured article. This year has proved no exception, and, in consequence, prices have slightly favoured buyers for long sides. American bacon has dropped considerably on the month, in the case of some cuts as much as from $6s.$ to $7s.$ per cwt. American hams have also been in very poor demand, and prices are down $5s.$ to $6s.$ since the end of January; and this has not had the effect of appreciably increasing the consumption. Canadian sides have been in fair demand, and with the moderate arrivals do not show much change in price for the month. Danish and Dutch sides have sold well, the arrivals of the latter being small. The shipments from Russia have been somewhat irregular, being delayed at the seaboard through stress of weather.

Prices in America are now several shillings above those current here, and in consequence cables report a curtailment in shipments to this country. American hogs have again fluctuated considerably during the month, ranging from \$6.65 to \$7.85, against \$8.10 to \$9.35 last year, and \$5.80 to \$6.80 two years ago. The Canadian packers still complain of the small number of hogs available.

Sales have recently been made of New Zealand carcasses of pigs, averaging from 120 to 170 lb., to be shipped during April and May at 5½*d.* per lb., delivered English ports. These should reach here during June and July, and after they are cured the bacon will cost about 60*s.* per cwt.

English pigs have been more plentiful, but in some districts an advanced price was secured for bacon pigs at the end of the month.

Cheese.—The general trade has been disappointing. Deliveries of the Canadian article from public warehouses have been of fair volume, but there has been a lack of fresh business, these deliveries being on contracts made some time previously.

The demand for New Zealand makes has not been as good as dealers wished and hoped for, and although some holders have been willing to meet buyers slightly in prices, orders have been small. It is now expected that the make in that country this season will not exceed that of last year. Recent cables report that the hot and dry weather in that country is decreasing the production both of cheese and butter.

Prices of cheese have fallen in the United States; best goods can now be bought at prices equal to 70*s.* per cwt., delivered in England. The stocks in Canada are now small, and are being held for more money than importers will at present pay; say around 59*s.* to 60*s.* c.i.f. All descriptions of English cheese are getting into small compass, and dealers are somewhat firmer in their ideas.

The stocks of Canadian cheese at the three principal distributing centres (London, Liverpool, and Bristol) at the end of the month were 210,000 boxes, against 221,000 last year, and 194,000 two years ago. Also the stocks of New Zealand in London were 27,000 crates (two cheeses in a crate), against 28,000 last year; in Bristol, 5,000 crates, last year 3,500 crates.

Butter.—In spite of the determined efforts of those largely interested to lift prices of best Colonial butter, the heavy arrivals have spoilt their chances of success, and on the month prices show little change; if anything, they are slightly in favour of buyers. At the end of the month values were 10*s.* to 15*s.* per cwt. below those current at the same time last year.

The first arrivals from the United States for this season reached us during the month, the prices for summer-made creameries being about 93*s.* c.i.f., which is a big reduction on the prices current in the U.S.A. Even this price is too high to admit of much business being done, in competition with fancy fresh New Zealands at 103*s.* to 105*s.* c.i.f.

Eggs.—There has been an unusual scarcity of all descriptions, the preserved stocks having been cleared earlier than usual, and the severe weather on the Continent, having curtailed supplies from that source, induced higher prices than usual.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and SCOTLAND in the Month of February, 1911.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	England.		Scotland.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per cwt.†	per cwt.†
Cattle:—	s. d.	s. d.	s. d.	s. d.
Polled Scots	8 2	7 7	39 1	36 0
Herefords	8 1	7 6	—	—
Shorthorns	8 0	7 3	37 11	35 3
Devons	8 1	7 4	—	—
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	9	8	9	7
Sheep:—				
Downs	8¾	7¾	—	—
Longwools	8¼	7¼	—	—
Cheviots	9¼	8	8¾	7½
Blackfaced	9½	7¾	8¼	7
Cross-breds	8¾	7¾	9	8
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs:—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	7 1	6 7	7 4	6 3
Porkers	7 10	7 3	7 9	6 8
LEAN STOCK:—	per head.	per head.	per head.	per head.
Milking Cows:—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	22 12	18 17	22 13	18 14
,, —Calvers... ...	21 19	18 11	19 15	17 13
Other Breeds—In Milk ...	19 8	16 2	19 14	16 7
,, —Calvers ...	—	12 15	20 5	16 16
Calves for Rearing	2 7	1 15	2 17	2 2
Store Cattle:—				
Shorthorns—Yearlings ...	10 5	8 18	10 16	8 15
,, —Two-year-olds...	13 19	12 1	15 3	11 17
,, —Three-year-olds	16 14	15 7	16 0	14 0
Polled Scots—Two-year-olds	—	—	17 9	15 5
Herefords— ,,	15 16	13 19	—	—
Devons— ,,	13 12	11 13	—	—
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	42 2	34 11	—	—
Scotch Cross-breds ...	—	—	33 6	28 10
Store Pigs:—				
Under 4 months	29 3	22 3	24 0	19 7

* Estimated carcass weight.
† Live weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND and SCOTLAND in the Month of February, 1911.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Quality.	Birmingham.	Liverpool.	London.	Manchester.	Edinburgh.	Glasgow.
		per cwt. *s.* *d.*	per cwt. *s.* *d.*	per cwt. *s.* *d.*	per cwt. *s.* *d.*	per cwt. *s.* *d.*	per cwt. *s.* *d.*
BEEF :—							
English	1st	52 0	53 6	54 0	51 6	53 0*	57 0*
	2nd	47 0	50 6	52 0	49 0	48 6*	54 0*
Cow and Bull ...	1st	46 0	45 0	45 0	46 6	45 0	46 6
	2nd	41 6	39 0	41 0	42 0	38 6	41 6
U.S.A. and Canadian :—							
Port Killed ...	1st	—	53 0	53 0	51 6	—	51 6
	2nd	—	49 6	50 6	49 0	—	49 0
Argentine Frozen—							
Hind Quarters...	1st	36 0	35 0	33 6	35 0	38 0	33 0
Fore ,, ...	1st	30 0	29 6	28 0	29 6	30 0	29 0
Argentine Chilled—							
Hind Quarters...	1st	38 0	37 6	39 0	38 0	37 6	39 0
Fore ,, ...	1st	29 6	29 0	29 6	29 0	29 6	31 0
American Chilled—							
Hind Quarters—	1st	—	—	57 6	—	—	—
Fore ,, ...	1st	—	—	39 6	—	39 6	—
VEAL :—							
British	1st	74 6	74 6	76 0	74 6	—	—
	2nd	65 6	70 0	66 6	70 0	—	—
Foreign	1st	—	—	74 6	—	78 0	—
MUTTON :—							
Scotch	1st	—	75 0	74 0	76 0	63 6	70 0
	2nd	51 6	70 6	65 6	71 0	53 0	52 0
English	1st	65 6	70 0	61 0	71 0	—	—
	2nd	51 6	65 6	56 6	65 6	—	—
Argentine Frozen ...	1st	32 6	33 0	34 6	34 6	32 6	32 6
Australian ,, ...	1st	30 6	29 6	31 0	29 6	—	31 0
New Zealand ,, ...	1st	—	—	40 6	—	—	—
LAMB :—							
British	1st	—	—	102 6	—	—	—
	2nd	98 0	—	98 0	—	—	—
New Zealand ...	1st	—	48 6	56 6	48 6	—	58 6
Australian	1st	46 6	37 6	43 0	37 6	—	42 0
Argentine	1st	43 0	38 6	43 0	38 6	44 6	43 0
PORK :—							
British	1st	67 6	68 0	67 0	69 0	63 0	62 6
	2nd	60 6	61 0	62 6	64 0	53 6	59 6
Foreign	1st	—	—	61 0	—	—	—

* Scotch.

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND in the Month of February, 1911.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Bristol.		Liverpool.		London.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
BUTTER:—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British	15 0	14 0	—	—	15 0	13 0
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Factory ...	—	—	95 0	88 0	98 0	94 0
Danish	—	—	120 6	118 6	119 0	117 6
French	—	—	—	—	125 0	121 6
Russian	102 0	96 6	100 0	96 0	104 0	101 6
Australian	105 6	101 6	104 6	100 6	103 6	101 6
New Zealand ...	108 0	105 0	107 0	104 6	106 0	104 0
Argentine	—	—	—	—	102 6	100 6
CHEESE:—						
British—						
Cheddar	75 6	61 0	74 0	70 0	81 0	72 6
			120 lb.	120 lb.	120 lb.	120 lb.
Cheshire	—	—	74 0	66 0	80 6	70 0
			per cwt.	per cwt.	per cwt.	per cwt.
Canadian	61 6	58 6	61 6	57 6	62 0	60 6
BACON:—						
Irish	70 6	67 6	66 0	63 0	70 6	66 6
Canadian	64 0	62 0	61 0	58 0	63 6	61 6
HAMS:—						
Cumberland	—	—	—	—	112 0	103 0
Irish	—	—	—	—	110 0	98 6
American (long cut)	62 6	60 6	60 6	56 0	67 0	61 6
EGGS:—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British	12 6	10 10	—	—	13 1	12 1
Irish	11 9	10 11	11 7	11 1	12 4	10 5
Danish	—	—	11 10	11 4	12 4	10 4
POTATOES:—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Langworthy	90 0	85 0	83 6	75 0	100 0	90 0
Scottish Triumph ...	81 0	76 0	63 6	58 6	82 6	72 6
Up-to-Date	86 0	76 6	63 6	58 6	81 0	71 0
HAY:—						
Clover	90 0	75 0	97 6	70 0	100 0	83 6
Meadow	77 6	60 0	—	—	89 0	66 6

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE, BELGIUM, and GERMANY, and at PARIS, BERLIN, and BRESLAU.

—		Wheat. 1910.	Wheat. 1911.	Barley. 1910.	Barley. 1911.	Oats. 1910.	Oats. 1911.
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
France:	January	40 2	46 11	25 8	26 3	21 0	21 6
	February	41 0	46 11	25 11	26 6	21 6	21 11
Paris:	January	42 0	48 3	24 8	26 2	20 8	22 9
	February	42 7	47 5	24 8	25 7	21 7	23 6
Belgium:	January	36 0	32 9	23 8	23 8	19 2	19 2
Germany:	January	44 8	41 2	26 5	27 10	21 2	21 5
Berlin:	January	48 8	43 2	—	—	22 11	20 11
Breslau:	January	45 10	38 3	26 2* / 24 6†	27 2* / 22 11†	20 4	19 8

* Brewing. † Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*, the prices for the German Empire representing the average of the prices at a number of markets.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of February, 1910 and 1911.

—	Wheat. 1910.	Wheat. 1911.	Barley. 1910.	Barley. 1911.	Oats. 1910.	Oats. 1911.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
London...	33 8	31 7	23 7	24 3	18 11	18 7
Norwich	32 11	30 4	23 8	23 5	17 6	17 8
Peterborough	32 1	29 7	23 8	23 10	17 1	17 1
Lincoln...	32 6	29 10	25 2	24 11	17 10	17 4
Doncaster	32 7	29 8	25 1	24 7	17 6	16 11
Salisbury	33 4	29 9	25 0	23 9	18 1	17 4

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1909, 1910 and 1911.

Weeks ended (*in* 1911).	Wheat.			Barley.			Oats.		
	1909.	1910.	1911.	1909.	1910.	1911.	1909.	1910.	1911.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Jan. 7 ...	32 9	33 6	30 5	26 11	24 11	23 11	17 5	17 2	17 0
,, 14 ...	32 8	33 8	30 8	27 1	24 11	23 10	17 5	17 7	17 2
,, 21 ...	33 2	33 9	30 11	27 3	24 11	24 4	17 8	17 6	17 4
,, 28 ...	33 0	33 6	30 11	27 6	25 0	24 5	17 9	17 4	17 3
Feb. 4 ...	33 4	33 7	30 9	27 7	24 10	24 5	17 10	17 7	17 5
,, 11 ...	33 8	33 4	30 5	27 8	24 9	24 6	17 11	17 11	17 5
,, 18 ...	34 1	33 0	30 3	27 11	24 6	24 7	18 0	18 0	17 6
,, 25 ...	34 5	32 7	30 2	28 0	24 2	24 9	18 0	17 10	17 7
Mar. 4 ...	34 10	32 7	30 0	27 11	24 6	25 0	18 2	18 1	17 5
,, 11 ...	35 8	32 6		28 4	24 1		18 2	18 0	
,, 18 ...	35 9	32 6		28 0	23 6		18 5	18 0	
,, 25 ...	36 0	32 9		28 0	23 7		18 6	17 11	
Apl. 1 ...	36 5	33 0		27 10	23 8		18 8	18 0	
,, 8 ...	37 4	33 6		28 0	23 1		18 10	17 11	
,, 15 ...	38 7	33 7		27 8	23 5		19 2	18 3	
,, 22 ...	41 4	33 7		28 2	23 0		19 9	18 3	
,, 29 ...	42 5	33 0		27 10	22 10		20 0	18 3	
May 6 ...	40 9	32 6		27 7	22 7		20 3	18 2	
,, 13 ...	41 6	32 1		27 3	22 0		20 6	18 1	
,, 20 ...	42 8	31 10		27 0	21 8		20 11	17 8	
,, 27 ...	42 6	31 3		26 3	21 4		21 0	17 10	
June 3 ...	43 1	30 2		25 7	21 8		21 3	17 10	
,, 10 ...	42 11	29 1		26 10	20 9		21 4	17 10	
,, 17 ...	42 7	29 0		26 10	18 11		21 6	18 0	
,, 24 ...	42 8	29 4		27 2	20 1		21 7	17 9	
July 1 ...	42 9	29 9		27 2	19 11		21 9	17 7	
,, 8 ...	43 0	30 4		26 4	19 5		21 8	17 4	
,, 15 ...	43 3	31 1		26 10	21 3		21 9	17 7	
,, 22 ...	44 0	31 11		27 4	19 9		22 5	17 5	
,, 29 ...	43 5	33 5		24 6	20 10		22 2	18 1	
Aug. 5 ...	44 9	33 9		27 4	20 5		22 11	18 3	
,, 12 ...	44 9	33 5		24 9	20 4		21 8	18 0	
,, 19 ...	41 6	32 11		23 11	20 11		19 8	17 11	
,, 26 ...	38 5	32 7		24 7	20 10		19 4	17 2	
Sept. 2 ...	37 2	32 2		26 3	22 10		19 6	17 2	
,, 9 ...	34 11	31 11		26 1	23 3		18 5	17 2	
,, 16 ...	33 6	30 11		26 5	24 3		17 9	16 6	
,, 23 ...	32 9	30 2		26 8	24 2		17 7	16 3	
,, 30 ...	32 2	30 1		26 9	24 4		17 2	16 4	
Oct. 7 ...	31 8	30 1		26 9	24 7		17 0	16 3	
,, 14 ...	31 4	30 2		27 0	25 1		17 0	16 2	
,, 21 ...	31 8	30 4		27 7	25 3		16 11	16 1	
,, 28 ...	31 10	30 4		27 9	25 4		17 0	16 2	
Nov. 4 ...	32 5	30 4		27 9	25 6		17 0	16 2	
,, 11 ...	32 5	29 11		27 7	25 4		17 1	15 11	
,, 18 ...	32 7	29 8		27 0	25 1		17 4	16 1	
,, 25 ...	33 0	29 11		26 8	24 10		17 3	16 4	
Dec. 2 ...	33 3	30 6		26 1	24 7		17 4	16 7	
,, 9 ...	33 3	30 9		25 7	24 3		17 3	16 9	
,, 16 ...	33 2	30 7		25 3	23 9		17 4	16 10	
,, 23 ...	33 1	30 7		25 2	23 10		17 4	16 9	
,, 30 ...	33 3	30 5		25 1	23 9		17 4	16 9	

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

DISEASES OF ANIMALS ACTS, 1894 to 1910.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(*From the Returns of the Board of Agriculture and Fisheries.*)

DISEASE.	FEBRUARY.		TWO MONTHS ENDED FEBRUARY.	
	1911.	1910.	1911.	1910.
Swine-Fever :—				
Outbreaks	132	106	273	188
Swine Slaughtered as diseased or exposed to infection ...	1,547	888	3,070	1,379
Anthrax :—				
Outbreaks*	93	118	178	242
Animals attacked	106	141	201	293
Foot-and-Mouth Disease :—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Glanders (including Farcy) :—				
Outbreaks	20	29	37	54
Animals attacked	75	87	130	169
Sheep-Scab :—				
Outbreaks	109	97	230	235

* For 1910 the figures show the outbreaks reported, but for 1911 the outbreaks confirmed.

IRELAND.

(*From the Returns of the Department of Agriculture and Technical Instruction for Ireland.*)

DISEASE.	FEBRUARY.		TWO MONTHS ENDED FEBRUARY.	
	1911.	1910.	1911.	1910.
Swine-Fever :—				
Outbreaks	6	4	23	6
Swine Slaughtered as diseased or exposed to infection ...	178	132	459	215
Anthrax :—				
Outbreaks	2	2	3	4
Animals attacked	2	2	3	4
Glanders (including Farcy) :—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Sheep-Scab :—				
Outbreaks	61	68	157	168

SELECTED CONTENTS OF PERIODICALS.

Agriculture, General and Miscellaneous—

Landwirtschaftliche Studien in Nordamerika, *Dr. K. von Rümker* and *Dr. E. von Tschermak.* (Landw. Jahrb., Band xxxix., Ergänzungsband vi., 1910.) [A. 80.]

Note on the Composition of Soot, *H. W. Harvey.* [B. 24–3.] The Interpretation of Experimental Results, *T. B. Wood* and *F. J. M. Stratton.* [B. 46.] (Jour. Agr. Sci., Vol. III., Part 4, 1910.)

Bericht über die Tätigkeit der K. Agrikulturbotanischen Anstalt München im Jahre 1910, *Dr. L. Hiltner.* [A. 28.] Versuche über die Wirkung und den Wert verschiedener Hederichbekämpfungsmittel, *Dr. L. Hiltner* and *Fr. Lang.* [B. 20–5.] (Prakt. Bl. Pflanzenbau u. Schutz, January–February, 1911.)

Field Crops—

Über Solanum Commersonii und Solanum "Commersonii violet" in Uruguay, *Gustav Gassner.* (Landw. Jahrb., Band xxxix., Heft 6, 1910.) [C. 26–11.]

Male Sterility in Potatoes, a dominant Mendelian character; with Remarks on the Shape of the Pollen in Wild and Domestic Varieties, *Redcliffe N. Salaman.* (Jour. Linn. Soc., Bot., Vol. xxxix., No. 272.) [C. 26–3; B. 17.]

Plant Diseases—

Crown-Gall (*Dendrophagus globosus*, Toumey), *G. Massee.* (Kew Bulletin, No. 9, 1910.) [E. 60–23.]

An Attack by the Large Larch Sawfly, *Nematus erichsoni*, *A. W. B. Edwards.* (Trans. Roy. Scot. Arbor. Soc., Vol. xxiv., Part I., January, 1911.) [E. 40–43.]

Cicinnobolus spec. als Schmarotzerpilz auf Spaerotheca mors uvae, *O. Oberstein.* [E. 60–25.] Über das Auftreten des nordamerikanischen Stachelbeermehltaues und des Eichenmehltaues in Galizien, *Dr. Gustav Köck.* [E. 60–25; E. 60–27.] (Ztschr. Pflanzenkrank., Heft 8, 1910.)

A Bacterial Disease of Swedes, *J. H. Priestley* and *A. E. Lechmere.* [E. 60–9.] The Fungicidal Properties of Liver of Sulphur, *F. W. Foreman.* [E. 20–5.] (Jour. Agr. Sci., Vol. III., Part 4, 1910.)

Untersuchungen über die Selleriekrankheiten und Versuche zur Bekämpfung derselben, *Dr. H. Klebahn.* (Mitt. Deut. Landw. Gesell., February 4th, 1911.) [E. 60–7.]

A Pine Disease (*Diplodia pinea*, Kickx.), *K. Bancroft.* (Kew Bulletin, No. 1, 1911.) [E. 60–17.]

Live Stock—

Die französische Pferdezucht im Jahre 1909, *Oetken.* (Mitt. Deut. Landw. Gesell., January 28th, 1911.) [F. 20.]

Weitere Untersuchungen über die Verdaulichkeit getrockneter Kartoffeln, *F. Honcamp* and *B. Gschwendner.* [F. 74–1.] Die Verdaulichkeit der getrockneten Kartoffelpülpe, *F. Honcamp. B. Gschwendner,* and *D. Engberding.* [F. 74–1.] (Jour. Landw., Band 58, Heft iv., 1910.)

Birds, Poultry and Bees—

Wanderversammlung deutscher, österreichischer und ungarischer Bienenwirte in Budapest, 19th–24th August, 1910. (Ungarische Biene [Budapest], August, 1910.) [K. 16–5.]

Interim Report on the Poultry Industry in Germany, *E. Brown.* (Jour. Nat. Poultry Organ. Soc., Vol. v., No. 1, 1911.) [K. 12–5.]

Forestry—

Wood Preservation and Preservatives, *G. S. Boulger.* (Jour. Land Agents' Soc., December, 1910.) [L. 28–3.]

The Vegetation of Woodlands, *Dr. W. G. Smith.* (Trans. Roy. Scot. Arbor. Soc., Vol. xxiv., Part I., January, 1911.) [L. 20–3.]

Engineering—

Les tracteurs agricoles, *Max Ringelmann.* (Bul. Mens. Off. Renseig. Agr [Paris], December, 1910.) [M. 4–1.]

Economics—

A Paper on the Organisation of Agricultural Credit under Land and Local Credit Societies, *R. M. D. Sanders.* (Trans. Surv. Inst., December 12th, 1910.) [N. 6–1.]

ADDITIONS TO THE LIBRARY.

[NOTE.—The receipt of *annual* publications of foreign agricultural and other departments, experiment stations and societies is not noted in the monthly list of additions to the Library. A list of these publications appeared in the *Journal* for October, November, and December, 1909.]

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Supplement

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REPORTS

ON THE

WORK OF THE INTERNATIONAL AGRICULTURAL INSTITUTE

BY

COUNT FAINA,

President of the Institute,

AND

M. LOUIS DOP,

Vice-President of the Institute.

LONDON:
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Richard Clay and Sons, Limited,
BREAD STREET HILL, E.C., AND
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THE INTERNATIONAL AGRICULTURAL INSTITUTE was founded at Rome in 1905 with the co-operation of the governments of most of the principal countries of the world, and since that time great progress has been made in placing the organisation of the Institute on an effective basis.

The Board of Agriculture and Fisheries think, therefore, that it may be opportune to bring to the notice of agriculturists in Great Britain the objects and work of the Institute in order that they may become acquainted with the efforts which are being made on behalf of agriculturists in all parts of the globe.

The present publication contains two statements, made respectively by the President and the Vice-President of the Institute, explaining the way in which the Institute has been organised, and the results that it is hoped to obtain. Full particulars of the steps leading to the foundation of the Institute and of the subsequent proceedings will be found in two Parliamentary Publications [Cd. 2958, price 1*s*. 7*d*., and Cd. 4727, price 9½d.], which can be obtained from Messrs. Wyman & Sons, Fetter Lane, E.C.

BOARD OF AGRICULTURE AND FISHERIES,
4, WHITEHALL PLACE,
LONDON, S.W.

April, 1910.

INTERNATIONAL AGRICULTURAL INSTITUTE.

Report by Senator Count Faina, *President of the Institute.*

(*This Report was read at a Meeting of the General Assembly in December*, 1909.)

Before considering the subjects mentioned in the Agenda, it is well that you should know what has been our task during the past year, how we have worked towards its completion, the difficulties we have met, and the results we have obtained. My present duty is the more pleasant because I am absolutely convinced that every possible effort has been made to realise the hopes conceived by the founders of the Institute, and on the part of the adhering Governments. I beg you to be patient and indulgent, because my subject does not lend itself to an eloquent discourse, even if I were an orator.

Provision of a Building for the Institute.

What was the position of the Institute when the first General Assembly adjourned [1] and relegated to the Permanent Committee the completion of the task which was necessary before the Institute could commence its regular work? The building only and a part of the Statutes were in existence. Erected in the short space of fifteen months, under the supervision of the Royal Italian Commission, the building is due to the munificence of the august Founder of the Institute. In the Budget prepared by MM. Vassilière and Lesage in 1905, the sum of £25,000 had been inserted as "rent or annual payment towards a sinking fund." Having to provide a building, the Royal Italian Commission considered that it would not be suitable or advisable to take one on lease, especially as it might be difficult to furnish it

[1] See "Further Papers and Correspondence relating to the International Agricultural Institute" [Cd. 4727]. Price, 9½*d*.

suitably. The Commission was still less inclined to build one at the cost of the adhering States, as provided in the Budget. It preferred to fall back on the liberality of H.M. the King of Italy, who most generously consented to grant, as from the month of July, 1905, the promised annual contribution of £12,000, a grant which really was not expected until 1910, when it was assumed that the Institute would commence operations. The payments made from the King's Privy Purse during four and a half years, and the free grant of land by the Italian Government, enabled the erection of the palace in which you are now. It endows the Institute with a property exceeding £80,000 in value; and the payment of £54,000 in advance has provided a residence, completely furnished and worthy of the Institute. It represents an annual saving of £4,000, a sum which would have reappeared in the successive Budgets as an annual payment towards a sinking fund, if the building had been erected at the cost of the Institute.

In view of the future development of the Institute and the probable necessity of further accommodation for the library, records, &c., the Royal Commission searched for building land in the neighbourhood, and found a suitable situation in the Villa Cartoni, adjoining the Villa Umberto I. Purchased by order of the King of Italy, with funds generously supplied by his Majesty, the land does not consequently form part of the actual estate of the Institute, but when it becomes occupied the goodwill also reverts to the Institute.

PENSION SCHEME FOR THE STAFF.

The Statutes prepared by the delegates to the Permanent Committee, and presented at the first session of the General Assembly, referred to that Assembly itself, to the Permanent Committee, and to the selection of the Staff. Elaboration of the last-mentioned subject was required, and the Permanent Committee dealt with it at the outset, because it was necessary to provide the technical machinery for the Institute to commence its work. The Permanent Committee therefore drafted Regulations regarding the Staff, and devised a pension scheme which requires a brief explanation.

In order to provide for the payment of a pension to each

official, the Institute earmarks a sum equivalent to 15 per cent. of the normal salaries. The amount is used partly for the purchase of an insurance policy and partly towards the formation of a savings-bank fund. The insurance is on the mixed system; *e.g.*, in the case of survival beyond sixty-five years of age, or of death, the policy reverts either to the widow or to the children, or conjointly to the widow and children, of the assured person. If he is unmarried or childless, he may will the policy to one or more of his legitimate heirs. The amount of the policy is equivalent to one year's salary as regards the General Secretary and the Heads of Divisions; to one and a half years' minimum salary for the Librarian and Heads of Branches; to one and two-thirds years' salary for the Assistants to the General Secretary; and to two years' initial salary for the Editors, Translators, Clerks, and Shorthand-Typists.

The difference between the sum representing 15 per cent. of the salary and the cost of the policy is paid into a savings-bank fund, which is guaranteed by the State, or it is converted into Government securities, and the amount remains to the credit of the official. The interest which accrues is added to the capital sum. The right of withdrawal is withheld until the completion of eight years' service, and the fund reverts to the Institute if, before the completion of that period, the official terminates his service for any cause whatever. In case of death the amount to his credit in the savings-bank reverts to his legal heirs.

We believe that we have by this means satisfactorily complied with the legal requirements of the Institute, which do not permit financial engagements to be made for more than a year, and which require that adequate provision for the officials must also be made. The following results which the system will provide show that the necessary conditions have been fulfilled. A second-class editor-translator, who joins the Institute when he is twenty-five at an annual salary of £160, will receive—assuming that he remains in the same grade—a final payment of £288 after thirty-six years' service. When he is sixty-five years of age he will, moreover, draw the sum of about £2,480 (at $3\frac{1}{2}$ per cent. interest), which could be converted into an annuity of about £260.

No pension system which exists in the adhering States probably provides so many advantages to the officials, the State retaining complete liberty of action.

SELECTION OF THE STAFF.

The Permanent Committee, having completed the Regulations concerning the Staff, undertook the difficult task of selecting its officials. The work was long and laborious, because there were differences of opinion on the subject. Some delegates thought that selection should depend on one consideration, viz., the competence of a candidate as regards his special work; whilst other delegates considered that this qualification should be balanced by the question of an international Staff, as indicated in the Regulations (Art. 46). This opinion was based on the obvious necessity of recruiting the Institute from candidates possessing a knowledge not only of various languages, but also of the agricultural, economic, and social conditions of different countries. The practical application of these considerations involved considerable difficulties. It was easy enough, on principle, to see the importance of an international Staff, but the Permanent Committee did not always possess the information necessary to decide with certainty as to the special suitability of candidates for the duties to be entrusted to them. The candidates were obviously unknown to the large majority of the members. A delegate might, moreover, conscientiously say that his candidate was fully competent on certain subjects, and had even shown brilliancy in former situations, but it might be difficult for him to affirm that the result would be equally satisfactory when the candidate undertook absolutely new work, such as will be dealt with at the Institute. It was, indeed, possible that the new official, in spite of his qualifications, might find himself in unexpected difficulties in the performance of those special duties.

It therefore became necessary to find the best means of reconciling the two aspects of the matter, viz., the ability and competence of the candidate and the necessary duties which demand very special qualifications. The Committee considered that the required result could be obtained by engaging each official, without distinction, on an agreement terminable

on either side by giving six months' notice in advance. As regards the Staff below the grade of Heads of Branches, the rule always obtains that those officials are not definitely appointed until after a period of six months' probation. The following appointments were made on the understanding indicated above:—Three Heads of Divisions and six Heads of Branches, selected from seven different countries, during the month of February; and seven officials of various grades during the period between February and June. The majority of these higher officials joined their posts during the month of April.

WORK OF THE PERMANENT COMMITTEE.

The preparation of the scheme of technical work occupied the Committee during the months of May and June. It consisted of two principal parts, viz.:—(1) a Report on the organisation in each country of the official departments bearing on the work of the Institute and the results which will be obtained therefrom (this inquiry was to be made during the second quarter of 1909); and (2) the inauguration, as from the 1st January, 1910, of a periodical service of information on subjects selected as suitable in the preliminary inquiry.

It was not possible at the outset to determine the number of officials who would be required, and the qualifications which they should possess. The Permanent Committee therefore decided, as a temporary measure and for the current year only, to authorise the President of the Institute to make arrangements with the Special Committee, in accordance with Art. 42 of the Regulations, for the provisional engagement of the Staff necessary. It is advisable to mention here that this procedure gives to the Institute an additional safeguard as regards the choice of suitable persons, because those who are engaged temporarily must, in case of their appointment on the Staff, still remain on probation for six months.

As work progressed in the various Departments, the Permanent Committee completed the Statutes by revising the Regulations relating to the internal procedure of the Divisions, Library, &c. Subsequently, as the technical work

developed, the Permanent Committee was able to supply certain preliminary Reports which were necessary to ensure the satisfactory working of the Institute in future. The Agenda for the General Assembly were thus being gradually prepared, and at this stage, indeed, the Permanent Committee gave most of its attention to them, the various subjects and reports mentioned therein being carefully and exhaustively discussed.

I have only touched on the principal points which the Permanent Committee examined, and I shall conclude this part of my Report by quoting a few figures which are really more convincing than words. Since the meetings of the General Assembly in 1908, the Permanent Committee met on 18 occasions, and its consultative bodies—the Special Committee and the three Permanent Committees—held 21, 18, 17, and 7 meetings respectively. The important Sub-committee of the Third Permanent Committee, formed to consider the proposal of M. Saenz-Peña relating to the creation of an Emigration Bureau, held four sittings.

Duties of the Various Departments.

A short account of the duties of the various Departments is now given :—

The General Secretary's Branch.

The General Secretary's Division consists practically of two Branches: (1) the General Secretary's Branch, and (2) the Library; the former dealing with correspondence and records, as well as with the duties of the bursar, the accountant, and the cashier. For the sake of brevity and lucidity, I shall quote a few figures only. The Staff dealing with correspondence and records consists of an Assistant to the General Secretary, an Editor, a Record-keeper, and two Shorthand-typists. Their work included 18 reports of proceedings of the Permanent Committee, with a large number of appendices, 1,795 letters received, and 1,442 replies, including 11 printed and 35 typewritten circulars. In order to realise the full extent of the work, it must not be forgotten that this particular Division acts as the connecting-link between the Permanent Committee and the various Departments; between

the Institute and the Delegates to the Permanent Committee; and between the Institute and the adhering Governments. It is, moreover, responsible for discipline among the Staff.

The Bursar's Office contains only one official, who superintends the subsidiary Staff, as well as the heating and lighting arrangements, the furniture, &c., and the purchase of the working material which is needed. In addition to his ordinary duties, the Bursar has supervised the extra work of furnishing the Institute, to the order of the Royal Italian Commission or of the Institute itself, involving the considerable expenditure of nearly £4,800.

The Accounts Branch remains in charge of an Italian Government official, who receives a gratuity for his services. The accounts are kept by the Bank of Italy, which also receives on deposit whatever money is available for that purpose. Salaries and small accounts are paid by cheque drawn on the Bank of Italy by the President of the Institute. It would have been difficult, in my opinion, to find a more simple, certain, precise, and economical system of payment. The Institute has had the advantage of following the plan adopted by the Royal Italian Commission, which had produced excellent results, as is proved by the fact that the Institute obtained £520 interest from the money on deposit during the year 1909, whereas the bank charges only amounted to £24.

Library.

The second section of the General Secretary's Branch, *i.e.*, the Library, is of the utmost importance to the Institute. It is the very heart of the organisation, collecting the material and distributing it to the various parts. In order to fulfil its important function the first object was to obtain suitable periodical or other publications, and an application was made, with this intention, to the adhering Governments on the 29th April, 1909. The letter explained the aims and work of the Institute, and it invited the Governments to supply official publications on subjects of interest to the Institute, which they had issued during the previous ten years, with a request to continue the supply in future.

Although very satisfactory results were obtained, it has naturally been necessary to make certain purchases which have cost about £720.

When the Library receives the working material, it distributes it as follows:—the volumes are placed in the Library, where they are subdivided into periodical publications, newspapers, and reviews. The titles of the books are indexed, catalogued, and classified. Books are catalogued according to: (*a*) subjects, on the decimal system adopted by the Bibliographical Institute of Brussels; (*b*) authors, in alphabetical order; (*c*) countries, limiting the publications to single countries and to subjects which relate directly to the work of the Institute. The classification of the volumes is made according to their size. Periodicals and newspapers are filed in the Newspaper Room, where a register according to countries is kept. These publications are examined, and suitable contents are duly noted, the extracts being also classified on the decimal system, according to subjects, so that they can be systematically indexed. A copy of the list of publications received in the Library is sent every day to the various Departments. The list of articles in periodicals is similarly circulated once a week.

It is obvious that the duties of the Librarian are considerable, intricate, and difficult, more especially as the publications which reach the Library are printed in every variety of language. It was therefore necessary to recruit the Library Staff from different nationalities, and to utilise the talent so obtained. It was therefore decided to transfer to the Library the work of translation required by the various Departments. In addition to the Librarian, the Library Staff at present includes nine officials of various grades, viz., editors, translators, clerks, and shorthand-typists. This number is not in excess of the requirements, in view of the fact that from the 1st May to the 11th December, 1909, 5,411 publications, comprising 9,840 separate parts, were catalogued; 420 magazines were received, from which 12,500 index-cards were made. The work of the Library will be realised from the publication which will shortly appear as the first volume of the Annals of the Institute for 1909. It will include a subject-index of the books in the

Library; a catalogue, according to countries, of the magazines and newspapers which are regularly received, and a subject-index of their contents which refer to the objects of the Institute.

The Second Division.

The Second Division deals with technical subjects indicated in Art. 9, (*a*), (*b*), (*d*), of the Convention of 1905, viz.:—(*a*) to collect, elaborate, and publish, with as little delay as possible, statistical, technical, or economic information regarding the cultivation of the soil, its production, whether animal or vegetable, the trade in agricultural products, and the prices obtained on the various markets; (*b*) to send to interested parties, in a similarly rapid manner, full information of the nature above-mentioned; (*d*) to notify the new diseases of plants which may appear in any part of the world, indicating the districts affected, the spread of the disease, and, if possible, the efficacious means of resistance.

In order to carry out this work, the Division has been subdivided into four Branches: the first and second, dealing with agricultural production and trade in agricultural products respectively, constitute the Department of Agricultural Statistics; the third and fourth, dealing respectively with plant diseases and "agricultural intelligence," are separate Branches, although they have been temporarily working together.

Statistical Department.

The following duties were referred to the Department of Agricultural Statistics during the second quarter of 1909:—

I. The preparation of a Report on the organisation of the agricultural statistical departments in various countries. The information was intended to describe the different departments and their staff, the object of the statistics, the methods of collection and tabulation, and the dates of collection and publication. The subjects were to be grouped under three heads, viz.: agricultural census, annual agricultural statistics, and financial and trade statistics. Analogous work had fortunately already been prepared by the Royal Italian Commission, so that in many cases it was only necessary to complete details by asking for the necessary documents and information from the adhering Governments. This explains

why it has been possible in a few months to issue so large a volume concerning twenty-two countries. The publication has been issued as the second volume of the Annals of the Institute for 1909. The monographs are of special value because, before publication on the responsibility of the Delegates to the Permanent Committee, each section was submitted to the respective Governments, thereby ensuring additional accuracy.

II. The next duty of the Department referred to the collection of the following statistics:—(*a*) Area under various crops according to the last official agricultural census, in countries where such an inquiry is made, with a comparative statement from previous statistics, if possible, the object being to indicate the importance of taking an agricultural census; (*b*) comparative data, from the annual statistics, of the area under various crops in 1908, and during the ten preceding years; (*c*) a tabular summary of the world's production of the seven crops which the Institute intends to record from the 1st January, 1910, by means of periodical reports, viz., wheat, barley, oats, rye, maize, rice, and cotton; (*d*) a census of farm animals in the adhering countries according to the latest official returns; (*e*) import and export ("*special trade*") statistics regarding the seven agricultural commodities already mentioned.

In spite of the difficulties and magnitude of this undertaking—*e.g.* delay in the supply of statistics by various Governments—and of the labour of converting the different figures to one unit, it has been possible to prepare tabular statements regarding agricultural production and cattle. The work must be carefully checked and amplified before publication, we hope at an early date. But even as it now exists, it is of great service to the General Assembly.

Various methods have been tried to complete the work relating to importation and exportation. An endeavour has been made to collect statistics of all products in a small number of countries, as well as statistics of a few products in all the countries. The results, however, could not be satisfactory owing to the existing condition of the statistics of foreign trade, and the information which has been collected does not, in our opinion, usefully indicate the direction, or the extent,

of trade currents, *i.e.* the very subjects which are of most interest. A renewed attempt must therefore be made to obtain better results.

Another subject referred to the Department of Agricultural Statistics related to the preparation of a Report on the stocks, and on the consumption and distribution, of the principal agricultural products. It was the intention to supply a statistical summary of the production of, and trade in, agricultural products, and to indicate as accurately as possible the average quantity of the principal agricultural products required for consumption in the various countries. It was, however, not even possible to commence the work, because one source of information failed, viz., the trade statistics, and the statistics regarding the stocks were very incomplete.

Yet another preliminary inquiry was proposed, viz., a collection and analysis of the resolutions adopted by International Statistical and Agricultural Congresses. The importance of the subject cannot be over-estimated, because it indicates the experience of past years. This work has been satisfactorily completed, and it will be published as an appendix to the Report on the statistics of agricultural production and cattle, to which reference has already been made.

In addition to preliminary collection of facts, the Department was authorised to form an "intelligence department" for the seven products included in the scheme which the Institute intends to inaugurate in 1910. The attempt has been made, and the result is of great importance to the Institute, but it is not of sufficient public importance to justify publication.

It is not surprising, from the above description of the work of the Department of Agricultural Statistics, that its staff consists of fourteen officials of various grades, in addition to two Heads of Branches. The officials were appointed gradually as required, provisionally in the majority of cases, and as non-established. By this means the staff could be easily reduced if the normal work justified such a course.

Plant Diseases.

I have completed my observations on the Department of Agricultural Statistics, and I now give a short account of the two other Branches of the Second Division. The Branch

for Diseases of Plants had been authorised to supply a Report on relative organisations in various countries, including information on the existing legislation, and on the State scientific institutions dealing with plant diseases. An endeavour was made to enter into relation with as many as were known, and an exchange of publications was proposed. These preliminary inquiries were made conjointly by the Plant Disease and Agricultural Intelligence Branches, because each of them must necessarily obtain information from the same sources, which, in this instance, included no less than 888 institutions and scientific publications.

The inquiry regarding the organisations dealing with diseases of plants was such an immense task that it could not possibly be completed within a short period. It has, indeed, only been possible to collect most useful material which will be employed at an early date, and, we hope, ultimately published in the form of a complete and accurate Report.

Agricultural Intelligence Branch.

The Agricultural Intelligence Branch was formed in the month of August, 1909, and it has already done a considerable amount of work. Apart from its collaboration with the Branch for Plant Diseases, it has also commenced to collect the material required for its special functions, and extended bibliographical researches have been made as regards the necessary books and periodical publications. Information regarding theoretical and practical agriculture has also been extracted from the principal articles contained in the publications and newspapers supplied by the Library. It was specially for this purpose that the bibliographical extracts which have been already mentioned were made. The Library indicates certain articles, and the Intelligence Branch selects the most interesting for its purpose, and tabulates the contents. The index-cards are then systematically filed, and form a most useful compilation of information for all kinds of inquiries regarding scientific and technical agriculture. In a few months, and with the help of only one official, more than 1,600 analyses have been prepared from the most important agricultural articles which have been published recently.

The Branch has also been able to send replies to all the official and private inquiries which have been received.

Economic and Social Questions Relating to Agriculture.
(Work of the Third Division.)

I must still rely on your patience to explain, although the subject is not very interesting, the work of the Third Division, which consists of a Branch, already in existence, for the study of economic and social institutions relating to agriculture, *e.g.* agricultural credit and insurance, rural co-operative associations; and of another Branch, which is in process of formation, for the investigation of the wages and conditions of rural labour.

The first duty of each of these Branches was obviously to obtain information regarding existing conditions. A preliminary inquiry was necessary for this Branch of the Institute as well as for the others. In practice, two opinions were expressed within the Permanent Committee on the subject of economic and social institutions. Some delegates desired for each country a series of monographs relating to all institutions dealing with agricultural credit, to the insurance of the *matériel* and *personnel* connected with agriculture, and to any form of co-operative associations, which exist in the interests of agriculture or of agriculturists. Other delegates, on the other hand, considered that the better way, which would also facilitate the completion of the work, would be to limit the inquiry at present to the consideration of co-operative associations. This view was accepted on account of the general desire to obtain, before the meeting of the General Assembly, information regarding official and non-official statistics, as well as on the nature and importance of co-operative societies in the different countries. The difficulty, moreover, of collecting bibliographical information regarding certain social and economic factors which have marvellously developed in certain countries, and remained stagnant in others, where, indeed, they have scarcely received official notice from the statistical point of view; and the delay in the supply of the material asked for from the Governments and the principal Associations, explain why we are unable to present a complete Report to the General Assembly. The

work is, however, so far advanced that its early completion is expected, as well as its publication in the Annals for the year 1910, prior to the inauguration of a regular Intelligence Service.

The Branch dealing with Rural Labour is still in process of formation. The Permanent Committee, fearing that an excess of work undertaken at the outset with a comparatively new staff might not be completed, authorised the President to request a gentleman who is a specialist on the subject to prepare a Report on statistics relating to wages and rural labour in various countries. In view of the favourable opinion expressed by the Third Permanent Committee regarding the publications of the Italian Department of Labour, the President entrusted the task to one of its officials. The plan of the inquiry includes, for each country: the nature of the census of the rural population; the official statistics regarding the movement of the rural population at home and abroad; and the methods of collecting official statistics of wages, and the result thereby obtained. The Report is now complete as a whole, but many details are still required, and it is therefore not yet available. When it has been submitted to the Permanent Committee and to the respective delegates, it will be published with the full conviction that its contents are correct and exhaustive.

My Report ends here. I have endeavoured to give it rather an objective character, leaving it to you to consider the facts and the methods to which it refers. We now await your approbation of our work during the past year, *i.e.* the initial period, which is perhaps the most anxious time in the history of the Institute. We await your approbation with confidence, ready at once to undertake the task of collecting details regarding the agriculture of the world. The preparatory work has now reached such a point that we are fully convinced of the possibility of dealing with a periodical and regular service of information. It is because we have confidence in ourselves and in your goodwill that, for the first time, we have inserted in the Budget the annual sum of £12,000—a grant most generously made by H.M. the King of Italy for the regular working of the Institute.

REPORT BY M. LOUIS DOP, *Delegate of France and Vice-President of the Institute.*

Published in November, 1909.

The most characteristic testimony of the universal zeal which prevails at present is the ever-increasing desire to discuss questions which affect the political or economic interests of nations. It even includes subjects which, by their complexity, appear to be beyond the limits of this general inclination towards unity. People from different parts of the world meet together, they agree, and they co-operate mutually for concerted action as regards certain special interests. Even Governments, willingly or unwillingly, are obliged to take the direction which points to international agreement and towards objects which are, apparently, beyond hope of attainment. As in the political world, isolation tends more and more to disappear in the economy of nations.

This statement can be easily proved. Consider the various international peace societies and, more especially, the International Arbitration Tribunal at The Hague. What are they, if not a concrete and eloquent manifestation of the desire of nations and of Governments to remove every cause of conflict, every menace of war?

It would be easy to refer to unofficial international agreements made at various Congresses, &c., in connection with economic, industrial, or commercial matters. Governments also, during the last few years, have come to mutual understandings as regards certain questions which affect the economic conditions of life. Treaties of commerce, the international bureaux or offices which have been established at Berne and Brussels, in London, Berlin, and in Paris—all are due to a wish, an anxiety, common to nations and Governments, to harmonise the factors which affect the economic welfare of the people.

Hitherto, as regards agriculture, private initiative has, apparently, taken the only part in this great international movement. The International Agricultural Commission, the International Dairy Federation, international mutual and co-operative federations, and numerous similar institutions,

have already rendered important services to the agricultural world.

As regards analogous action on the part of Governments, only a few attempts, timid and isolated, can be traced, *e.g.*, the endeavour on the part of the French Government in 1878 to organise international agricultural statistics as recommended by the International Statistical Congress, the Phylloxera Conventions, the Conventions for the Protection of Birds, and the Sugar Conventions.

The good results obtained in certain cases suggested opportunities of agreement on a wider basis, and the subject attracted the attention of an enthusiastic American citizen, Mr. David Lubin. Firmly convinced of the injurious effects of the isolation of agriculturists, impressed by the defective and empirical methods which obtain in agricultural production and trade, moved by the loss and, too frequently, the ruin caused by the effects of speculation in agricultural produce, he decided to make the attempt of placing on an international basis the consideration of questions which affect the agriculture of the world in order to provide a means whereby producers could be shielded from the bad effects of harvests which are precarious, uncertain, and consequently unprofitable. The intention was to bring the production and consumption of the whole world more into harmony—a noble idea, but a difficult task which, moreover, seemed hopeless to very many economists and agriculturists.

The task, however difficult, and the ideal to be attained, attracted and captivated the King of Italy, H.M. King Victor Emmanuel III., who undertook to carry out Mr. Lubin's suggestion. It was this kingly enterprise which created in 1905 the International Agricultural Institute of Rome.

These observations are necessary to explain the intention of the foundation of the International Agricultural Institute, and in order to indicate the many difficulties—technical, administrative, and diplomatic—which confront the representatives of the various Governments to whom is entrusted the important task of completing so vast and complicated a scheme without interfering with the supreme rights of individual States.

The general object of the Institute can be explained in very few words, viz., the improvement in the condition of agriculture in the various countries.

The improvement in question refers not to one country only, but to agriculturists throughout the whole world. A proposal of this kind is almost natural at the present time, when better methods of transport, easier means of communication, and more frequent intercourse between people of different countries, have created an international feeling of mutual interest among agriculturists.

The results of this solidarity may be more marked in certain countries than in others. Occasionally they may not even be apparent, or they may be attenuated by the isolating effect of hostile tariffs. It is none the less true that this solidarity does exist and that it increases with the growth of knowledge and with the progress of civilisation. Frontiers tend, more and more, to become mere administrative, fiscal or political fictions, and tariff walls may be useless to safeguard or protect the interests of producers when, for instance, the conquest of the air—which is no longer in doubt—becomes more fully realised. It is therefore necessary, even now, in view of new inventions and of improved means of communication, to adopt ways and means of minimising to the utmost the injurious effects of too sudden alterations in the conditions which mutually affect the nations.

The producer who is isolated simply cannot exist at present. Constant in his mind is the thought of keen and ceaseless competition from all parts of the world.

There are already numerous commodities, cereals in particular, which have the whole world for a market. Other products, *e.g.*, fruit, flowers, meat and dairy produce, which at one time had to be sold locally, are now exported to ever-increasing distances, owing to the adoption of refrigeration in transport, to increased speed, and to the preferential tariffs which are frequently given.

The local market, which gradually became national, is now international. Limits which are so wide demand from agriculturists an extensive knowledge of the conditions of production, as well as of the food requirements in every country.

Therein do agriculturists fail. Concerning certain products, many know little or nothing of the condition of the crops, of the prospects, of the quantity and quality of the harvest, or of the prices which are asked and given in the markets of the world.

Moreover, a rapid development of technical agriculture in any particular country, or new inventions, may very quickly and adversely affect the agriculture of another country. And, since progress does not extend in parallel lines throughout the world, certain countries remain behind to a marked degree.

It is in order to remedy such drawbacks which breed discontent, and occasionally even economic crises, that organised agricultural "Intelligence Departments" have been formed in most countries, to supply information to agriculturists regarding the state of the markets and the progress of their competitors.

The necessity for international action has been recognised as regards protection against diseases which affect mankind, and the International Institute of Hygiene at Paris was founded by several Governments in order to investigate those diseases and to discover means of resistance. Similarly would great benefits accrue if some international agreement could be made with reference to diseases which affect animals and plants. Agricultural products, unfortunately, carry with them the germs of plant diseases. Insects which are harmless in their own habitat sometimes become serious pests in other countries to which they are exported by chance. The danger is therefore universal, and agriculture would reap good results by means of international co-operation on the subject.

Finally, as regards economic and social institutions, would not nations benefit, as is indeed the case with individuals, by the existence of comparative studies of various institutions which, among men, regulate mutual relations, whether they be economic or social?

There can therefore be no question as to the existence of agricultural interests which are international. It is also indisputable that those interests may accord with, or be in

opposition to, the national agricultural interests of particular countries. It then becomes a matter of reconciling things which are apparently irreconcilable; of harmonising and blending, if possible, interests which are seemingly at variance with each other; of transforming complicated methods into a uniform and simple procedure; of joining the parts which unite and separating those which do not; and, finally, of discovering means of dealing with any economic factor in such a manner as to convey the absolute conviction that its adoption would tend to the benefit and progress of agriculturists throughout the world.

The next step is to know whose mission it will be to defend those universal interests; the authority, whether public or private, national or international, which will be authorised to organise the system considered as the best for their protection.

It was in order to solve these difficulties that a diplomatic Conference met at Rome in the month of June, 1905, on the initiative of H.M. the King of Italy.

Two different opinions were expressed at that Conference. One, representing private interests, would have left to private organisations the duty of defending the corporate interests of agriculture in general. The other indicated that, as it was clearly the duty of each Government to protect the collective interests of its people with regard to other nations, it was of supreme importance that the defence of those interests should be entrusted to a body sufficiently powerful to obtain, by virtue of its official origin, the force and moral influence necessary to give weight to its decisions.

This was the view which prevailed, with the proviso that international institutions should retain their own field and means of action. The whole subject was compressed into a short phrase which has become the guiding principle for all the acts and decisions of the International Institute of Agriculture, viz., "The Institute is an official institution."

This maxim was adopted by the plenipotentiaries as the basis of the constitution of the Institute. The Conference of 1905 also extended the structure, and in order to give vitality to the constitution it was necessary to ensure the following threefold results:—(1) to devise a method of State represen-

tation; (2) to indicate the lines of work; and (3) to prepare a financial scheme.

Such was the complicated problem which the Convention of 1905 endeavoured to solve by limiting its terms to their simplest form. The Convention thus became the charter of the International Agricultural Institute giving it vitality, action, and independence.

It would be unjust to omit reference to the remarkable analogy between the views of the French Government on the organisation and working of the Institute and the principles which formed the groundwork of the Convention of 1905. The opinions of the French Government were explained in a letter written by M. Ruau, Minister of Agriculture, when the Conference was summoned. With clear and accurate foresight of the main object of the Institute, and with keen perception of the best means for its attainment, M. Ruau stated the French case as follows:—

"The creation of an International Agricultural Institute on the plan intended by H.M. the King of Italy seems to have an object analogous to that of the French Office of Agricultural Intelligence, and appears to be similarly adapted to act as a bond of union between the different nations. The utility of an International Agricultural Institute as a Central and International Office of Agricultural Intelligence would appear to be incontestable. It seems necessary, however, to limit the *rôle* of this Institute exclusively to the three following subjects:—(1) the centralisation and publication of statistical, technical, or economic intelligence concerning rural economy, and the culture, production of, and trade in, agricultural produce; (2) the comparative study of questions of a technical or economic order, which appear to possess a general interest from an agricultural point of view; (3) the supply of information, in the form of resolutions, calling the attention of the various Governments, if necessary, to measures of a general and non-contentious character."

M. Ruau subsequently added that in view of the financial assistance which the different States would be bound to give, it was difficult to conceive the organisation of the International Institute on any other lines than by the meeting of permanent delegates of the different contracting Powers,

some of whom would form a sort of International Administrative Council charged with the management of the Institution and the fulfilment of its duties. Apart from these delegates, a staff for the ordinary work and for the translation of the various documents would have to be necessary.

The pith of M. Ruau's interesting letter is embodied in the Convention of 1905, more particularly in Art. 9.

THE CONVENTION CREATING THE INSTITUTE.

The Convention which created the Institute was approved and signed on behalf of 45 Governments. On the application of the States to which they belong, Colonies may also form part of the Institute on the same conditions as other countries.

The system of State representation was a very intricate problem. Were all countries to be placed on an equality, or was it not rather to the interest of the Institute to classify them according to the payments which each country consented to make? This method was adopted, and the number of votes at the disposal of a country is, at the meetings of the General Assembly or of the Committees, in proportion to the expenditure which it intends to bear.

Five groups of countries were accordingly arranged, with a voting power varying from one to five votes. The States in the same group contribute the same amount, and are entitled to an equal number of votes. Each selects its own group, and decides how much weight its influence is to carry.

If the various Governments contribute towards the expenses of the Institute in proportion to their resources and to their actual economic and social status, there is reason to hope that their influence will be harmoniously divided in relation to the importance of the interests concerned.

Methods of Representation.—A system of duplicate representation of the Governments was provided by the Convention, viz., representation on the General Assembly and on the Permanent Committee.

The General Assembly.—The General Assembly is the supreme authority of the Institute. It directs it completely. It has controlling powers over its executive organ, viz., the Permanent Committee. The Assembly is composed of dele-

gates from the adhering States. Each country may have an unlimited number of delegates, but with a definite number of votes according to the group to which it belongs.

The meetings are held at certain dates fixed by the previous General Assembly. The agenda are submitted by the Permanent Committee after being approved by the adhering Governments. The subjects selected are therefore intended to have considerable influence on the development of the Institute. They can be used by the General Assembly as a means of indicating the scientific and technical value of the Permanent Committee, and as a test of loyalty to the Convention and to the Regulations of the Institute. The suggestions of the Permanent Committee, prepared in the form of Reports, are used as the basis for the proceedings of the General Assembly.

The financial control of the General Assembly is very important. It fixes the total expenditure; it regulates and passes the accounts. It therefore combines the three-fold attributes of a Budget Committee, a representative Assembly, and of an Auditor-General's Department. Its functions are still wider because it has, to some extent, authority to revise its constitution, and its decision may under certain circumstances lead to a modification of the Convention.

The General Assembly submits to the adhering Governments for their approval modifications of any nature which entail an increase of expenditure or an extension of the powers of the Institute.

The power of revision, of control, and of modification is very interesting, although the procedure is lengthy and complicated. Remembering the principle (*i.e.*, an official Institution) on which the Institute was founded, it will still be possible, having regard to the changing nature of the interests which it is intended to protect, to develop the organisation on lines which need not necessarily remain absolutely rigid.

The Permanent Committee.—The executive of the Institute is vested in the Permanent Committee, which is essentially the vital organ. It consists of one delegate from each country, except in the case of the cumulative representation of several countries by one delegate.

As indicated in M. Ruau's letter, it has the nature of an

International Administrative Council, charged with the management of the Institute and the fulfilment of its duties. By analogy, the General Assembly resembles a general meeting of shareholders, and its special duty is to keep a check over the expenditure, the administration, and the strict observance of the Convention and Statutes of the Institute.

The Permanent Committee is therefore the active force, the engine—if such an illustration is applicable—which supplies motive power to the machine, and makes it work. It assumes effective charge through its President, Vice-President, and the Special Committee, which acts as an Executive Committee.

The powers of the Permanent Committee are most important. It elects its own President and Vice-President; it makes its own regulations; it votes the budget of the Institute within the limits of the sums placed at its disposal by the General Assembly; it appoints and discharges the officials and *employés* of the Institute.

Its considerable administrative and executive power and its duties therefore appear to justify the juridical character of its functions, viz., a form of International Administrative Council.

It follows that the interests entrusted to the General Assembly and to the Permanent Committee are both agricultural and international. From the practical and utilitarian point of view, the members should consequently have two qualifications: knowledge of agricultural questions and acquaintance with international subjects. The delegates to the General Assembly should therefore be diplomatists and specialists, but the delegate to the Permanent Committee must necessarily be a specialist as well as a diplomatist.

In this connection, it is important to observe that Governments can arrange for the representation of agricultural societies by nominating the best qualified members as delegates to the General Assembly, or even to the Permanent Committee.

ACTION AND FUNCTIONS OF THE INSTITUTE.

Its official character being recognised, how far may the Institute go? Its boundaries were defined by the Conference

—in Art. 9 of the Convention—and those limits are fixed.

The main object of the Institute is to issue, without comment, prompt and regular information regarding the various factors which influence the prices of agricultural products; to render thereby more and more difficult the speculation which, without profiting the consumer, obtains at the cost of the producer.

The Institute does not aim at the middleman, as some people have thought, nor does it intend to deprive traders of their legitimate remuneration for useful service in distributing produce widely and quickly. It merely proposes to resist as much as possible the influence of organisations which, by means of inaccurate information, artificially cause the sudden rise and fall of prices in the principal markets of the world.

The intention is to attenuate fluctuations in the prices of the principal agricultural products and, to a certain extent, to indicate "how to sell" and "how to buy," by promptly communicating, at fixed and frequent intervals, to those who are interested, reports concerning the growing crops throughout the world, the stocks in store and in circulation, and the probable demand. In general terms, the Institute must report on the agricultural situation throughout the whole world from the three-fold point of view of production, circulation, and consumption. It is a question of special statistics of which the universal, official, and dynamic character must be particularly noted.

In addition to information of a statistical nature, the Institute must also publish technical information. It must give a record of the progress in the different branches of agricultural science. It must collect, as in an agricultural encyclopædia kept well up to date, full details on the development of agriculture in all climes and countries.

Technical information regarding animal and vegetable products, agricultural industries, legislation and rural economy, agricultural education, agricultural machinery, questions of transport in relation to agricultural produce and other subjects, are also included in the work of the Institute.

Further, it is a Central Office for phyto-pathological in-

formation concerning diseases of plants. It will report on the subject of health and disease in the vegetable kingdom in general, with the more definite duty of notifying the appearance of new diseases of plants, indicating the areas affected, the remedial measures, and reporting on the legislation adopted or contemplated.

The Institute must also be a centre for statistics and observation regarding the wages of agricultural labour and the organisation of agricultural co-operation, insurance and credit.

Finally, the Institute may take the initiative on a very delicate subject. It has the option of presenting to Governments, for their approval, measures for the protection of interests common to agriculturists, and for the improvement of their condition. The Convention in this connection recommends the Institute to examine resolutions adopted by international Congresses or other Agricultural Associations. This selection of resolutions, which is one of the duties of the Institute, is theoretically of considerable importance because it implies on the part of the founders of the Institute a formal recognition of the actual and future utility of international Congresses, and a justification of the existence of the Commission which ensures their permanence.

From the practical point of view, the difficulty of utilising the work of private bodies is simplified. The decision also refutes the ill-founded reproach which has been made against the International Institute; viz., that it neglects private agricultural interests. Private bodies, without any restraint, have every reason to merge into national or international Federations; to pass resolutions at national and international Congresses, and to transmit them to the International Agricultural Institute, whose duty it is, in conformity with Art. 9 of the Convention, to consider them in drafting its own proposals to the Governments.

INCOME OF THE INSTITUTE.

It was necessary to provide regular and considerable resources so as to enable the Institute to perform its extensive work. The principle of State subvention was adopted, *i.e.*, by grants to which the General Assembly assents each year.

Each country subscribes in proportion to the share of influence which it desires to use in the administration of the Institute.

In addition to their ordinary income, mention must be gratefully made of the revenue received from important Crown lands, with which His Majesty the King of Italy has endowed the Institute. The income for several years from this source has been devoted to the erection of the magnificent building which is now the home of the Institute. This royal gift represents, at present, an annual and fixed income of 300,000 francs (£12,000).

The Convention of 1905 had settled the question of representation, but the administrative and technical organisation, as well as the management, of the Institute still required completion. An Italian Royal Commission, whose Chairman, Count Faina, is now the distinguished President of the Institute, had been specially appointed to draft the preliminary plans. The Permanent Committee continued the work, and ultimately embodied it in an extended draft scheme, which after approval by the first General Assembly became the Regulations of the Institute.

ADMINISTRATIVE AND TECHNICAL ORGANISATION.

The organisation of the Institute consists of three parts, viz. :—in ascending order—the (1) executive, (2) consultative, and (3) administrative bodies. Simplicity in the machinery and a maximum output have been the main objects in view.

The Executive and the Divisions.—The number of Divisions has been restricted to the necessary minimum, viz.: three, in order to concentrate the work and avoid a waste of force and of energy. By this means, it is hoped, with efficient assistance from the Staff and by grouping kindred subjects, to obtain the maximum amount of work. The Divisions have been organised on the plan of a division of labour in order to enable each official to appear at his best. Specialisation, as it obtains in the industrial world, has been the directing principle for the allocation of each functionary to the task for which he is specially qualified.

Along with and also above the Division which is the executive limb is the Sub-Committee, the consultative

technical body. One duty of each Sub-Committee is to consider and advise on subjects which come within its sphere. It may not and must not infringe the authority of the Permanent Committee, which alone and ultimately decides.

The members who also form part of the Permanent Committee do not retain altogether their representative character within the Sub-Committee. They are no longer representatives of a particular State, but official delegates invested with a technical mission, on an equality in their scientific and practical work, and with no voting privileges. The special duty of the Sub-Committee is to transmit to the Permanent Committee, after consideration, the technical reports supplied by the Divisions. Technical experts complete the consultative body.

The scale is further reduced, and in the second degree is placed a Committee of Selection—or rather a body of men independently selected by their colleagues on account of their ability, devotion, and scientific and personal qualifications, viz.: the Special Committee, which acts as the Executive Committee of the President of the Institute. The main object of the Special Committee is to collate the work of the Divisions and of the Sub-Committees, and to centralise the organisation and administration. It will direct, control, and elaborate the work of the subsidiary parts, establishing a unity of thought and of action in order to obtain from all the machinery a maximum of useful results with a minimum of useless efforts.

ADMINISTRATION.

The technical and administrative organisation aims at one object only, viz.: to obtain the best possible working system. What elements are employed to obtain this end?

Firstly, the Staff is international, an obvious consequence of the character of an official institution.

Secondly, the Regulations relating to the Staff ensure knowledge, experience, integrity, methodical and continuous work, initiative, promotion, and discipline. It also safeguards the moral and material welfare of the officials.

Who are the officials?

The General Secretary, who, under the direction and supervision of the Permanent Committee, is the administrative

Head of the Staff of the Institute. He is responsible for all the work and duties of his subordinates, leaving full liberty of action on technical subjects to the Heads of Divisions.

The Heads of Divisions are placed in charge of the technical service and their duties are most important. They are responsible for the practical working of the Institute. They are specialists whose technical duties are not obstructed by cumbrous administrative procedure. The Heads of Branches are also technical experts immediately under the Heads of Divisions; they are the representatives who replace the latter whenever necessary.

Other officials who contribute to the systematic efficiency of the Institute are: the Librarian, the Assistants to the General Secretary, the editors, translators, etc.

Sources of Information.

On what documents and information will the work of the Staff depend? The documents and information intended to be the working material of the Institute will be supplied directly by the Governments on their responsibility and through their agency.

It is therefore necessary that private Associations, Co-operative Societies and Syndicates should come to some distinct understanding with their respective Governments, because through their agency and instrumentality alone can private organisations enter into correspondence with the Institute. The relations between them and their Governments are questions of internal politics with which the Institute cannot interfere.

The work of the Institute will be made known by means of publications, bulletins, and communications to the Press.

It is well to observe that this organised work has only just commenced; and more especially to indicate to the agricultural and scientific public that the nature of the Constitution of the Institute and its scientific and technical parts require special machinery adapted to its special needs in order that methodical and systematic results may be obtained. Consequently, the progress of the Institute must needs be very modest and very slow at the outset, in view of the accuracy, impartiality, and precision which the Convention demands.

These observations indicate that the organisation and administration of the Institute are an object lesson illustrating the application of the maxim "practice with science." The Permanent Committee has endeavoured to give a solid basis of scientific accuracy to the practical side, and the results will show how far it has succeeded.

THE RESULTS OBTAINED.

The International Agricultural Institute, limiting its action to the duties imposed by the Convention of 1905, and by bringing practice and science into happy association, is now in a position to obtain accurate data for Governments and agriculturists. The extent to which this information is obtainable will now be considered.

Doubts have been raised in various quarters whether the Institute will be able to do anything which is of practical or scientific value. More pessimistic persons have even insinuated that this is to be expected because the Institute, after an existence of four years, has indicated its existence merely by means of meetings where some mysterious project has been elaborated with a view to upset the economic conditions of the world. More generous, but more impatient, souls have taunted it with failure to revolutionise trade and agriculture; and certain economists, looking hurriedly at the dark side of the picture, have already expressed the opinion that the whole structure must be reconstructed on a new basis and by other methods.

This criticism is generally the result of opinions too hastily formed and of a total ignorance of the character of the Institute.

Anyone who wishes to study impartially the results actually obtained or those to be realised must really consider the limits indicated by the Convention of 1905, and that beyond those limits the Institute cannot go without risk of having the Convention denounced.

After reading certain criticisms received at the Institute, it is impossible to avoid being impressed by the misconception which exists regarding the various technical difficulties inherent to the administration of an institution which is so

new, so complex, and of such importance. Good intentions and ignorance are, surely, the obvious explanation, not to say excuse, for the existence of opinions which are founded on insufficient, or even erroneous, knowledge.

This memorandum has been written for the very purpose of enlightening the public on this subject. It is indeed our firm conviction that the critics of the Institute show a legitimate desire for its success as well as sympathy and a vivid interest in the institution, which, if it remain within its own limits, may notably improve the economic conditions in the various countries which are represented within its walls.

The public have of course a right to be clearly and accurately enlightened regarding the Institute and its actual and future results; and it is with the fervent hope of satisfying that wish that we are now fortunately able to give precise information on the work which has been accomplished.

The International Agricultural Institute started in the month of April, 1909, a small but competent staff having been selected from all parts of the world. The Institute, be it noted, has now done six months' effective work only.* The organisation of the administrative and technical branches took place during the years 1908 and a portion of 1909. The officials were appointed gradually between January and April, 1909. The various Departments were gradually so organised as to ensure the fulfilment of duties with sequence and method.

The composition of the staff being international, it was necessary also to ensure the fusion and cohesion of various efforts, energies, and faculties, which, however excellent individually, lacked, as a whole, the moral and technical uniformity which is necessary for the success of a complicated undertaking. Considerable time was, therefore, occupied in the selection of the staff, in the methodical arrangement of the duties, and in the preliminary examination of the work to be undertaken by the Departments. All this intricate arrangement and adaptation was quickly done, thanks to the excellent spirit shown by the new officials without exception. Their devotion and competence will enable the Institute, when the General Assembly meets in a few days,* to fulfil the

* Written in November, 1909.

promise made by our President, Count Faina, in the month of April, 1909, on the occasion of the visit of members of the International Federation of Master Cotton Spinners' and Manufacturers' Associations, that the Institute would be in a position to commence its regular functions in 1910.

The Principal Departments will, in fact, as from the month of December, 1909, be able to supply certain results which, although apparently fragmentary, will be to agriculturists and to Governments a proof of the vitality of the Institute, and an indication of the immense labour which is in process of elaboration.

What are those results?

I. WORK OF THE FIRST DIVISION.

In addition to its administrative functions, the First Division includes the Library, which collects and classifies the material which the various Branches elaborate. It therefore forms an essential part of the machinery of the Institute. The material which it collects ensures the existence and the good working of the technical services. Its organisation has therefore been considered primarily, and it is from the Library that the first results can justly be expected.

The Librarian of the Institute was commissioned to visit several large libraries in order to study their organisation and the best methods of classification; and it was decided to make arrangements for the compilation of a bibliography by the Institute in collaboration with the "International Catalogue of Scientific Literature" in London and the "International Bibliographical Institute" at Brussels. The preliminary enquiries induced the Institute to make the attempt of editing an agricultural bibliography, and the results obtained, now in course of publication, are of a most encouraging nature.

The Library prepares a bibliography of all the publications purchased or received by the Institute. The classification which has been adopted is according to the method devised by an American, Melvil Dewey, as amplified by the International Bibliographical Institute and extended—with reference to agriculture—under the technical direction of Senator Vermorel, Director of the Station of Œnology and Vegetable

Pathology at Villefranche (Rhône). Generally known as the "Extended Dewey or Universal Decimal Method," it is based on combinations of figures and symbols which indicate the title, or more exactly, the contents of each publication, according to the numerical order given. The system is extremely simple and ingenious, and an indefinite number of combinations can be obtained. The number really indicates a word which is understood in all languages, an essential condition and a fundamental one to every institution of an international character.

The Bibliographical Bulletin of the Institute which is now on the point of publication will facilitate the rapid collection of an agricultural bibliography in a form which can be easily kept up to date.

The utility of the Bulletin is obvious: (1) The International Agricultural Institute will enable libraries, agricultural schools, scientific institutions, specialists, economists and agriculturists, to obtain a complete bibliography of publications on agriculture and agricultural statistics, a task which would have been difficult if not impossible to undertake and to keep up to date by other means;

(2) The Bibliographical method adopted, the form of publication, and the rapid and regular issue of the Bulletin, will largely contribute to the extension of modern methods of research and practice—methods which are at present scarcely, if at all, known in agricultural circles, *e.g.*, the vertical method of classification or the "card-index" system. The completion of this bibliography by the Institute will be a most useful means of diffusing scientific knowledge. It will be the application of a principle which we constantly uphold, viz., practice with science.

The Library and its Bibliographical Service will supply the material required by the other Departments. Their activity, development and results are thus intimately connected with, and subject to, the Library in relation to its duties, organisation and extension. As it is not yet in regular working order and its collection of books is still very incomplete, it would be unreasonable to expect, at the present time, practical and tangible results from the Departments which it supplies. Nevertheless, the Staff cannot be too highly praised for their

good-will and activity; or the specialists who direct it for their competence and ability, which have enabled the Permanent Committee to submit to the General Assembly information which will be most useful for suggesting to the various Governments the means whereby the future success of the Institute can be assured.

II. THE WORK OF THE SECOND DIVISION.

The work of the Second Division and the results which have been obtained can be summarised under two main headings:

(A.) Enquiry into the organisation of the Agricultural Statistical Departments of adhering States:—

The Permanent Committee decided that, before preparing statistics regarding agricultural produce, it was necessary to know the exact methods employed in various countries for the collection of agricultural statistics and the organisation of the Departments concerned. This fundamental statistical information is indispensable to the Institute for its future work.

This preliminary but extensive enquiry was made with tact and ability, and its publication will be invaluable to the agricultural world. It will, moreover, enable a Government which has not yet organised a system of agricultural statistics to do so on the lines of the one most adapted to its economic conditions and to the special character of its agricultural products. The countries which already possess such a service will also have the opportunity of completing or improving their own system.

Another Report, dealing with the resolutions adopted by international agricultural and statistical Congresses, has also been prepared.

(B.) Essentially statistical work:—

The statistical work is divided into two categories, viz., preparatory and normal. The preparatory work consists of:—

(1) A census of agricultural production. It is necessary that the Second Division should possess, for its statistical duties, a statement of the agricultural resources of the various

adhering countries, based on the official statistics which it has been possible to collect. The information will be given in tabular form indicating:

(*a*) the total area and yield of all agricultural products for each country according to the most recent official agricultural census;

(*b*) the division of the land in each country under the different forms of cultivation, *e.g.*, cereals, woods and forests, vineyards, &c.;

(*c*) the yield per unit of the different crops in each country;

(*d*) the comparative yield and production in each country of the crops which are included in the annual statistics;

(*e*) a tabular summary showing the total extent and production of different crops in all countries during several successive years.

(2) A census of farm animals in the various countries of the world.

(3) Analytical summaries for each country, indicating the importation and exportation of agricultural products.

On completion of the preparatory work showing the balance of the world's agricultural production the Division will commence its normal and regular functions, viz., reports on, and even forecasts of, the condition of the crops in each country. This part of its duties cannot, however, be accomplished until the Governments agree to adopt a uniform method with a view to the amalgamation and co-ordination of the reports which they publish regarding the conditions of the crops and in order to obtain a forecast of the probable result.

The preliminary work naturally occupied the greater part of the time of the Staff of the Second Division, but the subsequent work which has been done already shows: (1) the impossibility of comparing the methods adopted in different countries regarding the existing organisations which collect information on the condition of the crops and agricultural statistics; (2) the possibility of finding, from the information supplied by the Governments, an index-number indicating the general condition of the crops in the countries which furnish information on this subject; (3) the complicated working of certain apparently subsidiary, but really

very important, services, *e.g.*, the methods of transmitting information to the Institute by the adhering Governments.

In concluding this summary, which shows that the duties of the Second Division are perplexing and difficult, it is well to indicate that the Branches dealing with "agricultural intelligence" and diseases of plants will, in due course, become very important, especially when the necessary Staff is available.

Considerable work has, however, already been done, and if the results do not yet meet all expectations it must be stated that the fault lies principally with the Governments which have not supplied the necessary information in spite of repeated and pressing requests. It must also be stated that certain States have no organised Statistical Departments, or else they are of too recent date to supply the details which the Institute requires.

Moreover, the statistical work of the Division is especially intricate, and it has been found necessary to give special technical instruction to the members of the subsidiary Staff. It follows, therefore, that the work of the Second Division must be done slowly, carefully, and gradually if the results are to be accurate and complete. The development of the Division is closely connected with the success of the Statistical Departments of the various countries. There is an intimate connection between cause and effect as regards the results which the Institute may yield and the progress which the Governments desire to attain.

III. WORK OF THE THIRD DIVISION.

As the Second Division deals with the organisation of agricultural statistics, so the work of the Third Division refers to the statistics of co-operation in the various countries.

It is intended to publish monographs on non-official, as well as official, statistics of agricultural co-operation, especially as regards the publications of certain large federations. The enquiry has been the more difficult because there exist no central official Departments whence the necessary documents could be obtained. Yet, in spite of the difficulties and with an admittedly insufficient Staff, the Heads of the Division

have, by their devotion and ability, supplied within a few months reports on agricultural co-operation in Italy, Belgium, Holland, Denmark, Finland, Germany, Austria, &c. These monographs, which are on the point of publication, will be of considerable service not only to Governments but also to agriculturists who, willing to join forces and find means of improving their condition, will be enabled to obtain advice regarding the formation and organisation of co-operative societies.

The work of the Institute at the end of six months therefore includes bibliographical publications, monographs on Departments of agricultural statistics, the organisation of, and preliminary work relating to, the library, agricultural and trade statistics, agricultural intelligence and diseases of plants, and the elaboration of methods of work throughout the Institute.

The subject is too complex, too difficult to appreciate, and at present of insufficient value, to enable the public to realise its practical importance. The results actually obtained are too fragmentary to attract and impress agriculturists, but they are sufficient to indicate the activity and vitality of the Institute. Agriculturists, economists, and statisticians will find therein the germs of hope which will develop into faith in a brighter future for universal agriculture.

FUTURE RESULTS.

It may seem strange to regard the future of the Institute when its inauguration is so recent, its work scarcely begun, its methods still vague, and when the results obtained have not yet impressed the agricultural world. But the seed-time precedes the harvest, and it is possible, now that the soil has been carefully prepared, to estimate the full harvest which the Institute will soon yield under the best conditions.

What then can be the future results of the Institute? In examining the scheme, the principal factor on which success depends must not be overlooked. The International Agricultural Institute cannot give more than it receives.

Its action is indicated and strictly limited by three considerations:—(1) it is limited by the Convention of 1905, which has defined the general working plan; (2) it is guided by the Regulations of the General Assembly and of the Permanent Committee, which are merely an administrative and technical paraphrase of the Convention; (3) it is in a large measure dependent on the assistance which the Governments are willing to supply, and on the actual and future position of agricultural organisation in the countries adhering to the Convention.

The Convention and the Regulations have definitely excluded from the scheme certain subjects which well-intentioned but imaginative persons desired, and still wish, to include. It is, above all things, necessary to eliminate every factor, every act, and every intention, which might or could constrain a Government to modify its policy at home or abroad.

The point cannot be too strongly impressed that the International Agricultural Institute is the outcome of a diplomatic Conference which submitted a Convention to the contracting Governments for their approbation and ratification. Every adhering State reserves the right of denouncing the Convention, a claim which is necessary to safeguard its liberty of action. The right will surely seldom—we hope never—be enforced, but the observance of the Convention by the Governments necessarily implies the rigid adhesion of the Institute to the strictly limited project assigned to it with the consent of the adhering States.

It is, therefore, absolutely necessary that the several deliberative, administrative, and executive bodies, viz., the General Assembly, the Permanent Committee, the Sub-Committees, the Executive Committee, and the various Departments should wisely and prudently restrict their projects and ambitions so as to avoid any flagrant violation of the spirit and letter of the Convention—an eventuality which might result from too wide an interpretation of the Articles of the Statutes. This is a danger that we are bound to indicate, because to ignore or even to neglect it would be to expose the Institute to the refusal of assistance by the Governments on which its very existence depends. To

protect it from this possible danger, and at the risk of appearing somewhat timid and modest, we do not hesitate to advise the authorities of the Institute to read the Regulations from within rather than from without. The implicit observance of Conventions with circumspection, discretion, and prudence is always the fundamental and essential condition of the existence of official international Institutes.

Nor must it be forgotten that the General Assembly and the Permanent Committee have, in a certain measure, retained the diplomatic nature of the Conference. Consequently, they must not be in a position to trouble Governments with proposals which might lead to serious economic complications. From the project everything has, therefore, been carefully omitted which might in any way affect questions of legislation relating to tariffs, public health, &c., so as to avoid any possible interference with existing treaties or with international trade.

The Institute has authority to investigate matters relating to economic and social institutions, and to wages of rural labour, but it is forbidden to touch so delicate a subject as emigration. It is impossible to confer on the Institute the right, or even the means, of direct intervention in the organisation of economic and social institutions, because such a right would be equivalent to intervention in the internal affairs of a country.

Under these circumstances, it may be thought that the Institute is incapable of doing any useful work; that, in its creation, the improvement of agriculture by the Governments was not kept in view; and that to found an International Institute, without giving it a direct and an authoritative right of intervention in international life, is to prevent any possibility of organisation. It may even be said that, above all, to found an International Institute on an official basis with the direct assistance of the Governments is surely to court failure and to impede progress.

It would be easy to retort that the foundation and existence of the Institute, apart from any positive result, and the fact that the Governments of the whole world have been successfully convinced of the advantage of consulting together regarding their general agricultural interests, constitute a success

which is, perhaps, without analogy in diplomatic and economic history. The International Tribunal of Arbitration at The Hague is the only existing analogy of similar importance.

Moreover, independently of the reason which would itself justify the existence of an official Institute and in order to refute the arguments in question, the complexity of international conditions should be carefully considered. The Governments have not impeded the current of international good feeling, and they have not desired to do so. On the contrary, they have endeavoured to organise it in such a manner as to ensure its permanence. With that intention they have tried to prevent a possibly unsuccessful undertaking from being quoted as an object lesson to discourage similar attempts in future. They have indeed aimed at the highest form of centralisation and international fellowship, but on condition that the spirit of liberty should ever prevail. The Institute must not take any active part in international affairs, *i.e.*, in the organisation of mutual relations it must not be led or misled by party spirit; it must not be used as a force to overcome opponents, but rather as a fixed light burning steadily above the troubled sea, to guide the ships that pass in the night. To those who seek the way, it must indicate the paths which others have taken and the heights which they have reached; to those who fail through lack of knowledge the Institute will give light and leading.

A task so exalted and so noble may yet appear too humble and too modest to those inclined to cavil at rudimentary official internationalism as too timid, in any case, to lead towards absolute internationalism. Examining the subject closely, one is forced to admit that the undertaking is really immense and overpowering. It is an endeavour, without precedent, towards the synthesis and generalisation of international economic interests.

The various Governments are henceforth invited, in a fraternal and cordial spirit, to seek together the true facts which are so difficult to find, to elucidate, and to express. The persistent co-operation of all the Governments will be necessary to accomplish the task. Indeed, whether it be agricultural statistics, or plant diseases, or technical,

economic, or social information, the Institute can know nothing from within. It has merely a reflex existence. Synthetically it is, and can only be, as a converging lens which receives impressions from the component States; materially, it is too far removed from the field of action.

Alone and isolated, the Institute would be impotent. But, as the brain elaborates the messages which are collected and transmitted to it by the nerves, so the Institute will receive and collate the information supplied by the adhering Governments. Its activity and its utility will mostly depend on their eagerness to send information and working material.

Nor need the assistance end there. Countries which have reached an exalted place in civilisation, in scientific and practical discovery, have not always attained an analogous position in the organisation and administration of their Public Service. On certain portions of the structure much care has been bestowed, and less on others. Not infrequently a chain has broken because one link was weak. This is a result of the conditions and necessities of national life. Economic and social institutions, for instance, may have reached the highest stage of efficiency in a country where agricultural statistics and bibliography lag behind. In another country the order may be reversed; so that the same degree of perfection cannot be expected in the administrative and technical Departments of all countries, or even an exact counterpart in two or more States.

The Institute, basing its work on information supplied by all the Governments, will therefore be unable to publish for the whole world results in such a complete form as those of certain Governments which have reached a certain degree of perfection. To attain that maximum of excellence is the ideal in view.

In practice, the Institute will only be in a position to give a universal average, raising that average gradually up to the highest point reached by the country which is foremost in this respect. The moral influence and the irresistible incentive which the Institute will give in this connection cannot be over-stated. By indicating the most perfect organisation and its advantage to the countries where it fortunately exists, a feeling of emulation will surely be

awakened and other Governments will be spontaneously impelled to re-organise their own system.

This is not a dream, or an attractive picture, imagined for the occasion. Facts prove the truth and accuracy of the statement. Indeed, although the Convention is so recent as 1905, and the Institute itself is but a few months old, its influence and moral authority can be traced in more than one case.

Certain Governments, including some of the most important, in order to be able to reply to the requests of the Institute, have, for instance, been led either to organise a Department of Agricultural Statistics or to improve the one already in existence, and to make provision for economic and social institutions which were either non-existent or scarcely developed.

Limited in its action by the absence, or the lack, of organisation in this respect in certain countries, the Institute will nevertheless induce those countries to improve their organisation by the publication of the advantages obtained in the more advanced States. Consequently, if the Governments support each other actively, as they have undertaken to do, the Institute will gradually attain the ideal of supplying for the whole world the information which the more advanced States supply for their own territory.

The practical results which public opinion expects will naturally follow the progress and improvement of those services: accurate crop reports, estimates issued without delay, regular and stable prices in the markets of the world, improvement in the economic and social conditions of the rural population—all these results will be obtained the more easily and the more quickly, as Governments become convinced that their own interests are intimately connected with the future of the Institute. The progress of the one will be in relation to the progress of the other.

Even so limited and regulated, the task of the Institute will still be immense, and the means at its disposal will always be insufficient for its requirements.

The Institute itself must therefore learn discipline; limiting its own aspirations, avoiding grand conceptions, restraining

its ambitions in proportion to the restricted means at its disposal. Not to court failure by attempting too much—that is the lesson to be learnt.

It will be wise and prudent, in carrying out its extensive, though limited scheme, to refrain from broaching simultaneously all the subjects which it includes. A small but well-cultivated garden is of more value than a barren estate; and, for the cultivation of its large domains, the Institute still lacks capital, labour and material.

My advice will be quite clear to those who remember, at the inauguration of the Institute, the words which I now repeat:—let us be modest and let us work.

Let us make a judicious selection among the numerous subjects which cannot possibly be investigated at present because of the insufficient means which are available. Let us compress the work; let us begin with the most important and the most pressing, so that we may obtain the most practical results.

Then, proceeding with method, regularity and sequence; and when assistance from the Governments becomes more regular and effective, let us widen our bounds and gradually extend our work to the entire scheme designated by the Convention.

Like a child which is learning to walk, the Institute is now beginning to show its strength, and, like the child, it is full of assurance and hope. But it would be foolish to make it bear any burden which, at present, would waste its strength; and it would be unreasonable, so soon, to expect results which will come with wisdom and years. The child reaches manhood before hopes are justified and realised. Similarly, it is only right to allow the Institute many years before the fulfilment of its aspirations, the realisation of its intentions, can be expected.

My distinguished teacher, M. Levasseur, once said to me: "The compiler of statistics is not a calculating machine; he must be a specialist on the subject which he is investigating; he must know it scientifically and in detail so as to be able to make inquiries which are to the point, to summarise the replies in logical order, to check the information, and to winnow the chaff from the wheat."

We also ask the public and agriculturists to be patient, so that the Institute may not be like a calculating machine, but that it may specialise on the subject within its sphere.

The good seed has been sown. With the assistance of the Governments, with the co-operation and goodwill of agriculturists, the time will come when the results obtained at the Institute will assuredly tend to improve the conditions of life.

R. CLAY AND SONS, LTD., BREAD STREET HILL, E.C., AND BUNGAY, SUFFOLK.

Supplement

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WHEAT:

PAPERS READ AT A MEETING OF THE

BRITISH ASSOCIATION

FOR THE

ADVANCEMENT OF SCIENCE

AT WINNIPEG, AUGUST, 1909.

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SUPPLEMENTS TO THE JOURNAL OF THE BOARD OF AGRICULTURE

In order to bring to the knowledge of British farmers the valuable information as to the growth and composition of wheat, which is contained in papers read at the Meeting of the British Association at Winnipeg in 1909, the Board of Agriculture and Fisheries have obtained the consent of the Association to the publication of these papers as a Supplement to the Journal of the Board of Agriculture.

They will be found to give in a concise form a summary of the experimental work which has been done in the production of new varieties of wheat and of recent research into the composition of wheat and flour.

Board of Agriculture and Fisheries,
4, Whitehall Place,
London, S.W.

June, 1910.

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BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

PAPERS READ AT THE DISCUSSION ON "WHEAT."

Held at a Joint Meeting between Section B (Chemistry), Section K (Botany), and Sub-section K (Agriculture).

WINNIPEG, AUG. 1909.

INTRODUCTION

IN planning the programme for the meeting of the Association it was felt that no more appropriate subject could be chosen for consideration than that afforded by wheat, Winnipeg being now the focus point of a great area devoted to the growth of the cereal. Arrangements were therefore made in advance to hold a joint meeting of Sections B (Chemistry) and K (Botany) and of the Sub-Section of Agriculture, for which communications were invited from various gentlemen known to be specially conversant with the subject in one or other of its aspects. The discussion took place on August 30, the President of Section B being in the chair. The papers then presented are here printed, together with an abstract of that part of the address delivered by the President of the Agricultural Sub-section which dealt with wheat; abstracts of two papers dealing with economic issues, communicated by Professor Mavor and Professor Brigham, are also appended to the discussion.

The civilised white man appears always to have enjoyed the use of wheat, no tradition being extant as to when it first became available. It holds an unique position among foods, being

regarded as the staff of life; as other races of men have made acquaintance with it they have adopted it in preference to other cereals; thus as a human food it is displacing rice, millet, and other grains in the East, and maize on the American Continent. The production of wheat, in fact, is now one of the most fundamental of the problems of our time and also one of the most complex; it raises many issues, and many interests are concerned with it.

Many varieties of wheat are known, differing more or less in character and in requirements. The grower has to discover which variety or varieties are suited to the conditions of his locality, and to cultivate that which will yield him most profit. It may well happen that the most profitable variety is not that which he can grow most easily, and he is in a measure obliged to effect a compromise.

In England, in the eastern States of America and other places where excess of water has to be avoided, drainage must be resorted to; elsewhere, in the western States of America and in India, for example, extensive irrigation works have been undertaken; where irrigation has not been possible special methods of cultivation are adopted, in order to secure the necessary supply of water—as among the natives of India and of Syria, and in the case of the system of so-called dry farming now in vogue on the western prairies of America. The old systems of husbandry were all arranged with the object of securing the maximum possible supply of food for the wheat plant.

Among the difficulties to be faced by the modern grower of wheat those due to drought, frost, and rust are the most serious.

Wheat is for a number of reasons an admirable crop for the pioneer. It is always saleable; it can be stored and sent long distances without deteriorating; of all agricultural commodities it is the easiest to transport. It is easily grown, requiring but little capital, and it does well on newly broken grounds; a few years of wheat cultivation affords an admirable opportunity of getting virgin land into condition for any other scheme of husbandry that may be desirable. As long as the present wave of expansion continues in Canada, Argentina, Australia, Russia, and elsewhere, enormous supplies of wheat will be produced under pioneer conditions, not necessarily as a permanent business, but to some extent, at any rate, as a temporary expedient. During the last twenty or thirty years the supplies have been so cheap as to displace wheat from its premier position in the rotation system of long-settled countries and to convert it into a by-product. The change came quickly and caused terrible loss and suffering to farmers who failed to take notice of its occurrence and to alter their scheme of husbandry. But the change is not ended; the

price of wheat is now going up—whether because of any slackening in the wave of expansion or, as some economists assert, because of the extraordinary output of gold in recent years, we need not discuss—and once more the proper place to be assigned to wheat in the scheme of husbandry becomes an open question.

The scientific problems are no less complex. Much must be done before the conditions necessary for the growth of wheat are fully elucidated. Although the requirements of the wheat crop are fairly well known, it is impossible at present to explain why a brick earth in Kent or Sussex will produce 45 to 55 bushels of grain without difficulty, whilst the stiff loam at Rothamsted only yields 35 to 45 bushels, no matter how well it be manured. The size of the crop is limited, among other factors, by the stiffness of the straw. If instead of standing up well the plants become "laid," it is costly to harvest; hence the farmer does not aim at the maximum crop, but at the biggest crop that will stand. Stiffness of straw is influenced by a soil condition not yet clearly made out; crops will stand on one soil, while others of the same kind will be "laid" on soil of a different type.

The different varieties of wheat are not all of the same market value. The exacting requirements of modern civilisation necessitate special sorts of wheat for special purposes. The baker, the confectioner, the biscuit maker, all have their own requirements, and modern fastidiousness has put a price on subtle differences that were not recognised fifty years ago. Some very interesting problems have thus been opened up, but they are as yet far from being solved. In particular many investigations have been made to discover why certain flours—the so-called weak flours—only give small, squat, heavy-looking loaves, whilst others—the strong flours—will yield large, well-shaped, well-aerated loaves. The strong wheat commands the higher price, since the public insists on having the large loaf, but whether it is intrinsically more valuable, whether it is more nutritive, has yet to be ascertained.

But the grower is not directly interested in the intrinsic value of the various wheats: his object is simply to produce the wheat that gives him the highest profit per acre. It is clearly a first requisite that the wheat grown should be adapted to the local conditions and resistant to the local diseases. In England the "weak" wheats are most profitable, in spite of their lower price per bushel; strong wheats do not yield sufficiently heavy crops to pay. One of the most important of the wheat problems of the day is to study the laws governing the production of wheat and see how far it is possible to impart any desirable quality by cross breeding. Is it, for instance, possible to breed a wheat that shall be as suited to the English climate as our present sorts are and at the same time possess the strength of the Manitoba wheats?

Still more important for the future wheat supply of the world are the questions whether it is possible to breed early ripening varieties and varieties resistant to rust—a pest which at present often seriously reduces the crop and is particularly troublesome in South Africa and India. If the process of maturation can be hastened only a few days, it becomes possible to extend the wheat belt further northwards and to escape the harvest frosts which sometimes cause so much trouble in Canada. Drought-resisting wheats are also wanted—varieties with narrow leaves and therefore less likely to lose water by transpiration.

The improvement of wheat by selection, in other words the search for new mutation forms, is going on in all parts of the world, but was necessarily uncertain so long as progress depended on accident. The re-publication of Mendel's work, however, has given an impetus to the study of cross-breeding and it is now possible to predict the way in which certain characters of the parents will appear in the offspring. It is not too much to say that when the virgin regions of the world are all inhabited the total production of wheat will be limited only by the limit set to the plant-breeder's work.

Speculation as to the future world-supplies of wheat are always interesting, but are particularly liable to be falsified. The factors are incompletely known. We are only now beginning to make soil surveys. Yet without some sort of a world survey it is impossible to say what area is suitable for wheat culture. It is not known how far improvement of the cropping power of the plant is possible, and whether we can ever hope to exceed the present run of yields under our present conditions of soil and climate. Nor is it known whether varieties can be found or made to grow in regions at present unsuitable, as, for instance, in northern latitudes where the summers are short though the days are long, or in the vast areas of the world where the rainfall is too small. It is especially difficult to attempt forecasts at the present time, when the dominating factor in the world's supply is the essentially transient supply sent in by pioneer workers in new countries. However, all countries are alive to the importance of the problem, and work on the subject is beginning in most of them.

I.

ON THE GENERAL ECONOMIC POSITION OF WHEAT GROWING AND THE SPECIAL CONSIDERATIONS AFFECTING THE NORTH-WEST OF CANADA.

A *Résumé* BY MAJOR P. G. CRAIGIE, C.B.

In the address which opened the deliberations of the Sub-Section of Agriculture (printed in full in the Transactions of the Association), the Chairman invited attention to the paramount influence exerted on problems of this type by the varying growth of population and the relative degrees in which from time to time different regions of the earth contributed to the production of wheat.

A review of the available statistics made it plain that, although some effort had been made to feed the largely augmenting populations of Western Europe by securing an increased yield from the acreage previously employed, it was mainly from the surplus of certain still exporting States of Eastern Europe, and from the ample and more lately peopled areas of North and South America, and in a minor degree Australia, that the inevitable deficit of bread corn in this quarter of the earth's surface had to be supplied. Although it was opportune and appropriate to enter at this Winnipeg meeting on a careful examination of the local features attending the rapid acceleration of wheat-growing in the North-West, sound conclusions respecting the relative extent of the future supply to be drawn from any single geographical area involved an examination of world-wide problems.

The conclusions of the statistician and economist were required, as well as the advice of the scientific investigator and experimentalist, before an answer could be given to the question whether, how far, and at what rate, with profit to himself and with benefit to the bread consumer across the ocean, the Canadian agriculturist —in the face of the conditions now existing or likely to prevail— could push the further extension of the well-nigh eight million acres of wheat land which the Dominion claimed to show in 1909.

By way of clearing the ground for this local discussion, reference was made to the effect of more recent statistics in dissipating the alarm which had been raised in 1898 by Sir William Crookes— largely on the authority of earlier data supplied by an American statistician—that the wheat-producing soil of the world, as a whole, was becoming unequal to the strain put upon it by the multiplication of bread-eaters; and that a wheat famine could only be averted by materially raising the world's average of wheat yield per acre on the surface at present devoted to that cereal by the beneficial magic of the chemist in making available a fertilising supply of nitrogen sufficient to raise that average nearly 50 per cent.

As a fact, much greater progress had been made in extending the wheat fields of the globe in various directions from 1897 onwards than in the years between that date and 1884. Even supposing it were true that the growth of men had outstripped the growth of wheat areas between 1884 and 1897 the recorded extension of the world's wheat fields in the next decade was well over that of population.

The remarkable period of stagnation, which left the areas under wheat in the United States in 1893–97 no higher than the 35,500,000 acres at which they stood in 1878–82—a phenomenon which so largely affected the pessimistic conclusions of 1898—had given way to renewed advance even in that region, and to more remarkable developments elsewhere. An upward bound of the curve of progress could be traced, not only in new but in some old-world exporting countries. Far too little attention had been given to the statistics which showed how, even in European Russia—as well as in Caucasian and Asiatic provinces of that Empire—wheat growing had increased, while the new factors of Argentina and Canada were playing a part far more potent and significant as to their future possibilities than was credited to them ten years ago.

Supplementing the details of the existing wheat areas of the world by estimates from other countries, and employing in certain cases later statistics now available, it seems probable that approximately 242,000,000 acres are at the present time devoted to the growth of this cereal, three great States or combinations of States supplying 150,000,000 acres of this total. Roughly, the distribution of the surface may be analysed as under, indicating the development of the last decade :—

Regions.	About 1898–9.	About 1908–9.
	Acres.	Acres.
British Empire	35,000,000	42,000,000
Russian Empire	47,000,000	60,000,000
United States	40,000,000	48,000,000
European States (not included above)...	60,000,000	64,000,000
South America	7,000,000	16,000,000
Minor States (partly estimated) ...	12,000,000	12,000,000
	201,000,000	242,000,000

So far as the defective records of still earlier periods than the above may be quoted, the total acreage of the wheatfields of the world in 1885 may have been slightly over 170,000,000 acres, and in 1893 about 190,000,000 acres. Since it may be assumed that no appreciable increase is shown in the 26,000,000 acres of wheat in India, included above in the total for the British Empire,

and no increase in the estimates of the last line of this table is presumed to have taken place, the localities where the greatest development of wheat-growing has occurred may be readily traced, and the accelerated rate of the extension in the most recent decade offers an assurance that the apprehended shortage of bread supplies is not yet in sight.

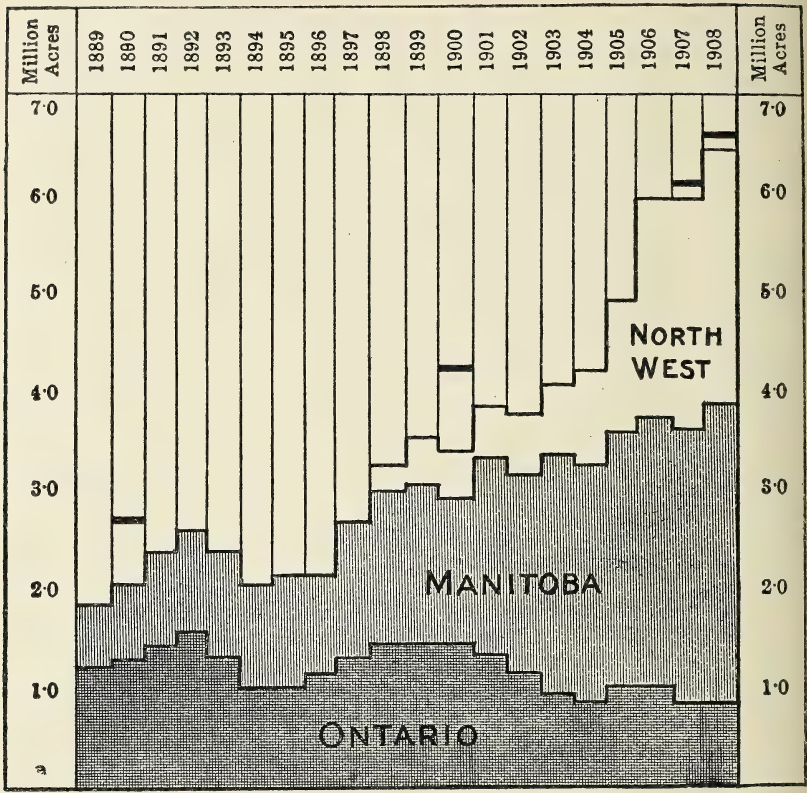
Estimates of the world's aggregate production are even less complete and reliable than those of acreage, but, comparing the figures forthcoming for the average of the three years 1895–7 with those for the last three harvests 1907–9, a total of 2,444,000,000 bushels of wheat would appear to have risen to 3,236,000,000 bushels, an advance of nearly 33 per cent. in this interval. This movement is certainly much greater than that of population in the period covered.

In view of the concern of the United Kingdom in the expanding imports of wheat, the following statement emphasises the changes which have occurred in the chief sources whence its supplies have been received, and illustrates the growing importance of the Canadian contribution to the needs of the Mother Country.

Annual Average Imports of Wheat and Wheat Flour (expressed as grain) into the United Kingdom and the Countries from which these Imports were recorded in the Trade Accounts in millions of cwts.

Periods.	Total received.	Of which from						
		U.S.A.	Argentina.	Russia.	India.	Australasia.	Canada.	All other.
1881-85 (5 years)	77·3	41·4	0·1	9·0	9·4	4·0	2·7	10·7
1886-90 ,,	77·8	37·4	1·2	14·5	9·2	1·9	3·4	10·2
1891-95 ,,	96·6	50·7	7·7	13·8	9·2	2·9	4·9	7·4
1896-1900 ,,	96·0	57·3	8·1	9·2	4·1	1·6	7·5	8·2
1901-05 ,,	111·6	42·3	14·6	15·0	15·5	7·1	10·5	6·6
1906-08 (3 years)	112·5	36·8	24·4	10·2	11·3	7·7	15·2	6·9

After illustrating the records of this renewed advance, the distinctively Canadian features of the movement were discussed in the address, and the difficulties which an investigator encountered in forecasting the future was acknowledged. Some illustrations of the widely divergent conclusions of competent experts were found in the discrepant estimates which Professor Mavor had collected (without himself adopting) from acknowledged authorities in his exhaustive Report of 1904. One of these estimates, it will be remembered, placed the land fit for settlement or "susceptible of cultivation," in the North-West as low as 92,000,000 acres, and another as high as 171,000,000 acres. One skilled estimator restricted the surface likely to be annually available for wheat to an aggregate of 13,750,000 acres, while another offered more than three times that figure, or 42,750,000 acres. The resultant produce



NOTE.—(*a*) The single black line across the columns for 1890, 1900, 1907, 1908, represents the estimated total acreage of the Dominion of Canada for which no continuous series of statistics exist.

(*b*) Were the preliminary estimates for 1909 taken into account, the total acreage would have been given as 7,750,000 acres—a rise of 1,139,000 acres in the latest twelve months. This is indeed the net result, for the West has added 1,402,000 acres —of which 1,289,000 were in Saskatchewan and 113,000 in Alberta—while there are declines in the East and in Ontario of 114,000 acres, and likewise a reduction of as much as 149,000 acres in Manitoba since 1908.

anticipated in the one case represented 254,000,000 bushels, and in the other 812,000,000 bushels, while the higher figure had the high authority of Dr. Saunders. It was, therefore, for the experts now assembled to say if the lapse of another quinquennium full of interesting movements, both of population and of crops in the North-West, had enabled them to arrive at any greater certainty as to the future.

It was incumbent on those who forecasted the wheat areas of coming years carefully to avoid exaggeration and loose deductions, and whatever ample surfaces they believed to await the wheat grower, and whatever tales were told of practically inexhaustible regions yet untapped, they must not neglect to bear in mind the necessity of enlisting for the improvement of the yield the very

promising aid which science in many directions, whether botanical or chemical, was now beginning to offer to the farmer.

The vast territories still available in the North-West should not in any case be looked upon as a mere wheat mine to be exploited and exhausted by the recurrent culture of a single cereal. The successful farming of the future, here as well as elsewhere, would demand more careful tillage, more scientific rotations and a watchful consideration of the changes going on in other lands in the grouping of the populations and the opening of other wheat fields than their own.

As a guide to the ascertained movements of the Canadian wheat area which the local statistics so far available afforded, the subjoined illustration was offered representing the areas as recorded separately in Ontario, in Manitoba, and in the North-West respectively since 1889. This showed how the area had diminished in the older province, where farming was becoming more mixed, and how it had extended in Manitoba, and still more rapidly in Saskatchewan and Alberta.

[Professor Mavor's Paper.]

In a Paper bringing up to date the conclusions of his Report to the British Board of Trade in 1904, discussing the production of wheat in the North-West of Canada (printed in full in the Reports of the Association), Professor Mavor explains the changes in the administrative divisions known at the earlier date as Alberta, Assiniboia, and Saskatchewan, and the extension due to their absorption of almost the whole of the former territory of Athabasca. The surface now included in the three provinces of Manitoba, Saskatchewan, and Alberta covers 357,000,000 acres of land and nearly 13,000,000 acres of water—together, 370,000,000 acres—as against 238,000,000 acres in 1904, the additional 50 per cent. lying, however, beyond the region of practical settlement for commercial production at the present time. The experience of the later five years strongly confirms Professor Mavor in his conclusions of 1904 that very great improvements in the productive powers of the country, and a very considerable increase in the effective population, as well as a more exclusive regard to wheat cultivation would have to take place before the North-West could be relied upon to produce for export to Great Britain a quantity of wheat even nearly sufficient for the growing requirements of that country. This exclusive attention to wheat he regards as unlikely to arise, since, even were the soil uniformly suitable and the seasons absolutely reliable, the disposition of the people, and their settlement in small farms, of which the owner is also the cultivator, seems against such exclusive cultivation of one

crop. The advice of the experimental farms, the Governmental encouragement of mixed farming, and the experience of the States immediately south of the international boundary, are all counter to continuous single-crop culture.

The writer makes the net gain in the North-West Provinces by immigration and by natural increase of immigrants between 1901–06 a total of 369,000, and adds that there being no reliable available statistics of either births or deaths in the North-West, the actual natural increase cannot be stated. In 1907–08 immigration had largely increased—the number received that year being the largest in the history of the country.

The policy of the distribution of immigrants in small isolated groups is then discussed, and a careful analysis given of the available statistics of immigration and the progress of cultivation and the relation traced between the increase of cultivation and the growth of the population. Professor Mavor puts the cultivated area per head of population as 8·6 acres in 1901, of which 5·9 acres was in wheat, whereas in 1906 the cultivated area was 9·9 acres, of which 6·3 was in wheat—*i.e.* 62 per cent., as against 68 per cent. at the earlier date. He traces the diminished proportion of wheat growing to the total acreage under all grain crops, which he puts as declining from 62·56 per cent. in 1905 to 55·44 in 1909, the drop being greatest in the latest years, 1908 and 1909. Oats, on the other hand, had shown the greatest proportional increase, from 24·86 per cent. to 33·57 per cent. This, however, he attributes chiefly to the amount of railway construction and employment of horses that has been going on in the three provinces.

The unsatisfactory condition of the collection of agricultural statistics in Canada at present, and the inconvenience of the periodic presentation of two differing sets of statistics—one compiled by the Dominion Government and another by the provincial authorities—is illustrated by Professor Mavor in the discrepancy of 16 per cent. between the wheat crop of 91,853,000 bushels given in 1908 by the former and that of 107,002,093 bushels by the latter for the three prairie provinces, while the latter figures seem to be adopted by the Dominion Department of Trade and Commerce. He advocates the employment of more expert statistical officers and an adequate agricultural survey of the whole region. Without this, only "fanciful" conclusions could be reached about the future productivity of a vast and very varied country.

Professor Mavor points out that the yield of wheat since 1898 per acre exhibited a fluctuation of from 9·11 in 1900 to 25·16 in 1901, being twice above 20 bushels and four times below 16. He finds no justification for multiplying the estimated acreages by the arbitrary figures of 20 bushels.

Irrigation notwithstanding, he finds no evidence that the semi-arid area can be relied upon to produce any considerable amount of wheat for export, but notes a very rapid increase in miscellaneous farming in this area; and he traces the progress of three irrigation schemes in the semi-arid regions of Alberta, giving interesting particulars of the largest scheme, that of the Canadian-Pacific Railway, which contemplates dealing with 3,500,000 acres of land and involves at present 1,000,000 acres.

The Paper further offers in detail interesting particulars of the course of land values, and a table is given of the advancing values per acre in the sales of land belonging to the Canadian-Pacific Railway from \$3·15 in 1901 to \$9·54 in 1908.

After discussing the various railway extensions and their bearing on the development of the North-West, Professor Mavor concludes his Paper with a reference to the varying estimates of possible wheat production quoted by him in his Report of 1904 from different expert authorities, and offers an amendment by those responsible for the lower one of 13,750,000 acres, which would, in the light of recent progress, add another 3,500,000 acres to that total, and a consequent enlargement of the resultant produce of this lowest estimate to 317,000,000 bushels, which would provide 232,000,000 bushels for export. He repeats, however, his own distinct disclaimer of any responsibility for the original estimate or its amendment, and urges, as before, the very numerous economic factors which have to be borne in mind in estimating the productivity of any country in this respect. He concludes that no one who examines the statistics of agricultural productivity in the North-West since 1883 can fail to be astonished at the progress made in twenty-six years. In 1883 the population was insignificant, and the one railway then constructed had not been completed to the coast. Now three great railways are crossing these provinces, and another forcing its way upward from the States. This population numbers a million, and its agricultural prosperity is advancing by leaps and bounds. The country, he adds, needs no fantastic exaggerations to draw attention to its achievements and its possibilities; it only needs a cool estimate of these and consolidation rather than excessive expansion. A vast amount of energy and capital have been wasted in attempts to exploit regions which are, and must long remain, distant from markets, while fertile soils easy of access have remained under cultivation of a highly primitive character. The immense natural resources of the rich soil of Manitoba and of portions of Saskatchewan and Alberta are not even yet being fully exploited. Very considerable improvements in agricultural methods must yet take place if their resources are to be fully utilised.

[PROFESSOR BRIGHAM'S PAPER.]

A Paper by Professor Albert Percy Brigham dealt with the development of wheat culture in North America generally. As may be seen from the text of this Paper printed in the Reports of the Association, its scope covered the history of the cultivation of this cereal and the striking changes which had occurred in the distribution of the area so occupied within the United States, the movement of wheat exports, and the prospects, on the one hand, of an increasing consumptive demand, and, on the other, of an augmented yield per acre from more scientific modes of farming. Professor Brigham quotes a variety of opinions as to the future of wheat growing within the United States and the various factors which have to be weighed before the declining importance of the American export trade become evident. He accepted the view that the future development of cereal cultivation in his own country depended more on improved methods than on adding new lands. If the United States has 150,000,000 inhabitants at no distant date, they would need 900,000,000 bushels of wheat for home supply. As already 700,000,000 bushels had been reaped in one year, an addition of only four bushels per acre on existing areas would fill the gap, while if they could add another 10 or 12 million acres they could keep up the present scale of export.

Towards the close of his paper Professor Brigham approached the remarkable conditions attending the wheat areas of the North-West of Canada and its capacity for future development.

He pointed out that, in comparison with some of its competitors, Canada was old in this industry, raising 20,000,000 bushels in 1827, while Argentina only began in 1882. The high level of the present Canadian yield was noted owing to the natural fertility of the prairies, the greatest crop ever raised from unfertilised land being credited to Canada in 1901, when 63,425,000 bushels was raised on something more than 2,500,000 acres, or more than 25 bushels per acre. Professor Brigham quoted on the authority of Mr. Blue, of the Census and Statistics Office at Ottawa, the crops recorded in each year of the present century (1900–08) separately for each of the three provinces of Manitoba, Saskatchewan, and Alberta. The exports of Canadian wheat ranged from sixteen and nine millions respectively in 1900 and 1901 to a maximum of 43,654,668 bushels in 1908. With reference to the recent northerly attempts at wheat growing, he quoted the experiments in the Peace River district at Fort Vermilion, 350 miles north of Edmonton, where 35,000 bushels had, according to Dr. Wm. Saunders, been raised in 1908.

If there was to be prophecy as to Canada's future product, her own experts must play the part of seer. He had not seen any

retraction or modification made by Dr. Saunders of his "reasonable prophecy" of 1904 that wheat grown on one-fourth of the land suited to it in the Canadian North-West with the yield of Manitoba in the previous decade would bring a crop of more than 800,000,000 bushels. If there be such a surplus of good soil as three-fourths, ample room would be left for diversified crops and such rotations and following as might be needful in future years to meet the declining production of the prairie soils.

After a reference to Sir William Crookes' forecasts in 1898, and the extent to which later data had outstripped his modest expectations, Professor Brigham declared it "hazardous" to set limits to wheat in view of possible unknown factors of production.

Sufficient account had not been taken of the limitation of population among the nations of the higher standards, who are bread-eating peoples. Any pressure on the wheat supply would foreshadow itself before the pinch came, and would tend to still further restriction of population. He agreed with an earlier conclusion of an American economist (Mr. D. A. Wells) that the world "for the first time in its history has now good and sufficient reasons for feeling free from all apprehensions of a scarcity or dearness of bread." Any increased demand in Western Europe, or more truly in North-Western Europe, would be fully met by developments in Canada, Russia, Argentina, Egypt, India, South Africa, and Australia, so that they might even leave out the United States, or even omit India should her wheat be needed at home to avoid periods of famine. Argentina was as yet undeveloped, and Russia backward in bringing her vast resources to full effect on the world's market. North America had the land, progressive appliances, skilled energy, and facilities of transport to supply the bread market of coming decades. No citizen of the United States of America need harbour a jealous thought if in that market a major place should come to her northern neighbour.

II.

THE FACTORS DETERMINING THE YIELD OF WHEAT.

By A. D. HALL, M.A., F.R.S., and E. J. RUSSELL, D.Sc.

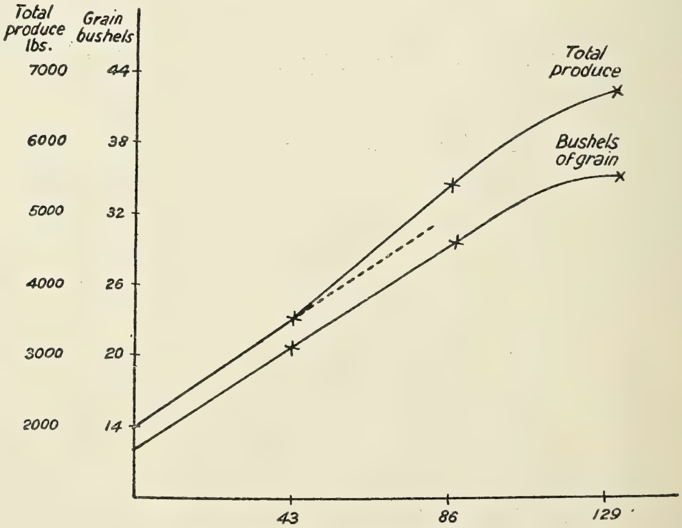
The Rothamsted experiments on wheat began in 1843 on the Broadbalk field on which wheat has been grown every year since. In the first few years a general idea was obtained of the requirements of the plant as regards manure; a scheme for the treatment of the plots was drawn up in 1851, and has been substantially adhered to ever since.

(1) FOOD.—The chief elements of nutrition derived from the soil or manure are nitrogen, phosphoric acid, and potash; lime,

magnesia, soda, sulphuric acid, and silica also play their part, but are supplied in sufficient quantity by all ordinary soils.

Nitrogen.—At the time the experiments were commenced the necessity for nitrogenous manures was denied by Liebig; several of the plots were therefore arranged to show the effects of different amounts and various forms of nitrogenous manure. It was soon demonstrated that nitrogenous manures were necessary, and that the yield was proportional to the nitrogen supplied. The action of two sets of factors may be traced in the results.

(*a*) If we have a series of plots, each receiving more phosphoric acid and potash than the plant can possibly require, the yield on each plot should be strictly proportional to the supply of nitrogen if the wheat plant be able to deal with all the nitrogen it receives. The amount of food a plant takes up, however, depends on the extent of the absorbing root surface. At first an increase in the amount of nitrogen in the soil increases the root system, and therefore the absorbing surface, as well as the amount of material that each unit of this surface can take up. Hence the yield is more than proportional to the supply, *i.e.*, the second increment of nitrogen on Plot 7 produces a larger increase than the first increment on Plot 6. When yield is plotted against supply of nitrogen the curve begins by being concave instead of linear. (Curve 1.)



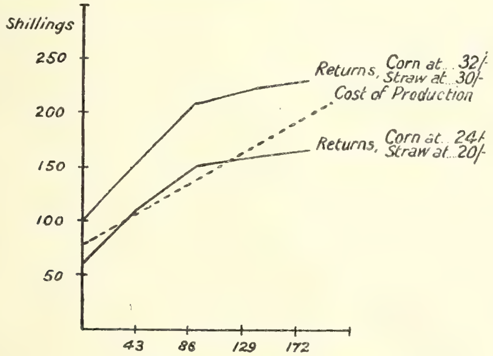
Pounds of Nitrogen supplied per acre.

CURVE 1.—EFFECT OF INCREASING SUPPLY OF NITROGEN ON THE YIELD OF WHEAT.

There are a few exceptional years in which this relationship does not hold.

(*b*) When further amounts of nitrogen are supplied, other

limiting factors come into play, the increase being smaller for the third and fourth increments of nitrogen. The curve of production becomes convex, illustrating the law of diminishing returns. There is an important practical application of this curve in districts where it is customary to manure for wheat. So long as the increased crop is more than proportional or is simply proportional to the supply of food, it may be profitable to go on adding manure. But when the yield falls off, a point is reached where further additions of manure are unprofitable.



Pounds of Nitrogen supplied per acre.

CURVE 2.—RETURNS FROM PLOTS RECEIVING VARYING QUANTITIES OF NITROGEN.

The diagram No. 2 shows the results obtained during a selected period of 13 years, when there were four plots receiving regular increments of nitrogen. The vertical distance between the dotted line (cost of production) and the curve of returns shows the profit or loss accruing from the varying quantities of manure. Up to a certain point, the better the farming the higher the profit; beyond this the profit falls off. The curve illustrates the law of diminishing returns and also Lawes' dictum that "high farming is no remedy for low prices."

The general principles which have just been illustrated that the earlier increments of nitrogen may produce increased yields more than proportionate to themselves, while later amounts are followed by a constantly diminishing increase—*i.e.*, that the curve of production is first concave and then convex—is true not only of nitrogen but of manure generally and of any of its simple constituents, should the experiments begin with a deficiency and end with an excess. The principle is also applicable to water supply and to many other factors, each of which may limit the crop production. For example, in arid climates the yield is generally unaffected by the supply of nitrogen because it is determined wholly by the water supply, enough nitrogen being always present to satisfy the needs of a larger crop than the limited water supply will permit of.

Phosphoric Acid.—Unlike barley and turnips, wheat does not respond to large quantities of phosphoric acid, but is well able to satisfy its requirements from the soil. Phosphoric acid, of course, is necessary, but its most marked effects are secondary. It hastens maturity, and is therefore effective in a backward season or in late districts, since it enables a crop to be harvested in time which otherwise might be damaged or lost. Extraordinary returns are obtained for small quantities of superphosphate in Australia.

Potash.—Wheat is usually able to satisfy its potash requirements from the soil, but at Rothamsted, on the plots which have become depleted of potash, the deficiency is shown by a reduced yield, especially in dry seasons, and by increased tendency to disease, rust, &c.

Organic Matter.—Autumn-sown wheat is less dependent than most farm crops on good texture of the soil, and grows freely even when the amount of humus in the soil is a low one. On the Rothamsted plots, where wheat has been grown for so long with manures containing no organic matter, no difficulty is experienced in obtaining a plant; the seed germinates and grows away freely. Similarly, Prout at Sawbridgeworth has grown wheat and other cereals on the same land since 1864, using no farmyard manure and growing clover (the roots and stubble of which would supply some humus) only about once every seven years. In England it is not customary to use much manure for wheat; in the Eastern Counties farmyard manure is very generally put on the temporary hay or clover before it is ploughed for wheat, but this is to some extent a matter of convenience in handling the manure. Beyond this, specific manures are rarely employed, except perhaps soot or a top dressing of nitrate of soda in the spring if the plant is backward. Wheat is usually grown after clover or a well-manured mangold crop, and therefore on land recently enriched with nitrogen; an excess of phosphoric acid is also generally applied to the turnip crop in the rotation, and its influence persists until the wheat crop comes round.

(2) RAINFALL.—Wheat being a deep-rooting plant and sown in England in autumn, is less dependent on spring and summer rainfall than most other crops. Thus the very dry years—1854, 1864, 1898—were all good wheat years; indeed, an old English proverb runs: "Drought never bred dearth in England." The lowest rainfall was in 1864 (18·5 inches), and the crop was above the average, especially on the plot receiving dung. Further, the great wheat growing districts of England are also those of lowest rainfall. Wheat is, therefore, one of the crops best adapted to dry regions, probably not because it requires relatively little water, but because it flourishes best in a dry atmosphere, and

possesses a large root system well able to supply the plant with water from that stored in the subsoil. It is generally recognised that wheat grows best in comparatively heavy soils, which retain a considerable store of the winter's rains for the service of the crop in the summer.

The effect of high rainfall is harmful in several directions. If it comes in autumn it washes nitrates out of the ground and militates against the development of a full root system, the chief process going on in late autumn and early winter. There is, therefore, a reduction of crop; indeed, over a period of years almost a mathematical reduction. Shaw has shown that the average crop in England varies above and below a certain limit in inverse proportion to the rainfall of September, October, and November, his formula for the Eastern Counties of England being —yield = 46 bushels—2·2 rainfall in inches. This formula only holds if the weather conditions later in the growth of the plant are normal; *i.e.*, a high yield is only possible if the autumnal rainfall has been low, but a low autumnal rainfall may on occasion be followed by a low yield because some factor depressing the yield has intervened later. If much rain falls at or a little before harvest time the corn does not ripen well, and is in any case difficult to get in. It is this circumstance that limits the northward extension of wheat in the British Isles. The limit can be pushed somewhat further by the use of phosphatic manures, which tend to hasten maturity and thus enable the harvest to be got in a few days earlier.

On the other hand, a good rainfall towards the end of spring is beneficial, especially if the spring is early; such a rainfall is a usual feature of the good wheat seasons. It is significant also that the exceptional years already referred to, in which the second increment of nitrogen produces *less* effect than the first, are generally years of low spring rainfall.

(3) TEMPERATURE.—High temperatures are not at all necessary for the production of wheat, excepting at the time of maturation. In the best season it commonly happens that the summer (June and July) temperature is *below* rather than *above* the average. For winter-sown wheat, a mild open winter, not too wet, is desirable to bring the plant forward in early spring, but is by no means essential.

Spring Wheat.—The conditions regulating the growth of spring wheat are not quite the same; owing to the shortened period of growth the yields are rarely so high, and the crop appears to be more susceptible to rust and other diseases. For a good yield it is essential that the soil shall contain enough moisture to ensure a good start to the seed, but any excess of rainfall in the first month or two of growth is prejudicial because it restricts the

development of the root system. Little is known directly of the manurial requirements of spring wheat, but probably, like barley and oats, it is less dependent upon nitrogen but more on phosphoric acid than autumn wheat.

The wheat plant in climates like that of England continues to take some food from the soil—nitrogen and phosphoric acid, for example—almost up to the time of harvest. Assimilation also continues as long as any part of the stem or leaves is green.

The process of seed formation consists in transferring previously stored starch, protein, &c., from stem and leaf to the seed, but the material transferred has much the same composition in the earlier and later stages of the process. That wheat which has been prematurely ripened through excessive drought or an attack of rust is exceptionally rich in nitrogen is probably due to the loss of carbohydrate from the grain by continued respiration, and not to gluten entering the grain first, to be followed by carbohydrates only in the later stages of filling.

The ripening process appears to be mainly one of desiccation.

(4) CONTINUOUS WHEAT GROWING.—At Rothamsted, where wheat has been growing on the same land for more than sixty years, there is little evidence of any secular decline in the yield due to the constant repetition of the crop, provided that sufficient fertilisers are supplied. On the unmanured plot and in cases in which complete fertilisers are given, the production tends to reach a constant level when long-period averages are taken to exclude the fluctuations due to season. That the Rothamsted yields are never so high as are sometimes attained under ordinary farming conditions is due to the type of soil and certain difficulties in cleaning and preparing the land when wheat follows wheat so rapidly.

(5) It is not, however, possible to analyse completely all the factors involved. Type of soil in relation to climate is very important. Thus the Rothamsted plots, even those receiving abnormally large dressings of manure, have only on two occasions (1864 and 1894) approached 50 bushels, which on a good brick earth would be by no means an exceptional crop even when grown, as usual in England, with but little manure. To each type of soil there is a limiting yield beyond which the crop will not go. But the limit is not the same for all varieties; it is not unusual to find that one variety may do much better than another under one set of conditions, but not so well under others. There is still a good deal of work to be done in inquiring into the soil conditions and reducing to precise terms such vague expressions as "a good wheat soil." For example, on soils not very dissimilar, with the same rainfall and management, a heavy wheat crop will stand in one case, while on the other soil it will invariably go down, and

as yet it is impossible to state definitely the factors which thus determine the stiffness of straw in one case and not in another. As wheat is largely a pioneer crop, and as the pioneer cannot control his conditions to anything like the extent that is possible in more developed parts of the country, it is important that wheat should be bred to suit local conditions.

III.

THE BREEDING OF WHEAT.

By Professor R. H. BIFFEN, M.A.

The widespread cultivation of wheat from very early times has led directly to the production of a very large number of distinct varieties, so that growers have abundant opportunity of choosing those which best suit their special conditions of cultivation. Wide as the choice is, however, few will care to admit that they have precisely the varieties they could wish for at their disposal; the improvement of existent types is, in fact, demanded in practically all directions. In most parts of the world the features of outstanding importance are strength, resistance against disease, and yield. Under certain conditions the power of resisting drought and that of maturing early are also of extreme importance, and any improvements in these directions would lead at once to a great increase in the area within which the crop can be cultivated.

Most of the wheat-growing countries recognise these facts, and several have made considerable efforts either to find wheats suitable for their needs or in some cases to produce them by cross-breeding. In Australia, Canada, and the United States such wheat-breeding experiments have been in progress during the past twenty years. On the whole the experiments cannot yet be said to have met with the success they deserve, with the possible exception of Farrer's in Western Australia, which promise to effect radical alterations in the types of wheat cultivated there. The reasons for this partial failure are now obvious. Breeders had no definite knowledge of the results to be expected from any particular cross. They knew in a general fashion that the operation resulted in "breaking the type" or inducing "great variability," and there was always a hope that amongst the variants some form would be found superior to its parents. Looking back on the records it is now obvious that the majority of their crosses were very unlikely to give results of value. Even when the desired types were found, the difficulties were by no means overcome, as it was necessary to fix the new variety; under the old conditions, this generally meant years of tedious "selection" and often ultimate failure.

The republication of Mendel's work and its speedy confirmation and extension altered the whole aspect of affairs by giving a rational explanation of the phenomena which had so puzzled breeders. It was proved that the variants were the results of recombinations of characters, obvious or otherwise, aleady existent in the parents; furthermore, it showed how the essential fixity of type could be secured.

To put wheat breeding on a certain basis it was necessary in the first place to trace the mode of inheritance of the many characteristics which in various combinations make up the existent varieties of wheat. With some few exceptions this has now been done, and it has been shown that nearly all the outstanding features of importance from an economic point of view "Mendelise" and can be brought together in any desired combination. Thus, by way of an example, a wheat of the general character of Rivett wheat, with its beard, grey colour, and rough chaff, but producing strong grain like that of Red Fife, can be bred and fixed in three generations by crossing Rivett wheat and Red Fife. Again, the same cross will give the corresponding beardless or white and smooth-chaffed types.

In view of the steadily increasing demand for strong wheats and the general shortage of the world's supply of such sorts, much attention has been paid to the inheritance of this characteristic. To simplify matters a strong wheat was defined as one capable of yielding a light and well-piled loaf—that is to say, a loaf of large volume, which stands well and does not flatten out in the baker's oven. Such a definition was necessary in view of the conflicting opinions current as to the real meaning to be attached to the term "strength."

Before deciding on the best varieties to use as strong parents many preliminary trials had to be made. These tended to show that strength was not so simple a characteristic as might have been expected. Many varieties possessing this feature in a high degree in their own countries, when grown under our climatic conditions gave wheat no stronger than our own weak sorts. This appeared to be particularly the case with some of the finest of the Hungarian varieties. Some few varieties, on the other hand, produced excellent grain when grown year after year in this country. One of the best examples of these varieties is Red Fife, or Galician wheat. This has now been grown over a period of sixteen years, chiefly in the West Midlands but also in many other parts of the country, and its grain can still compete on equal terms with the Red Fife imported from Canada as "Manitoba Hard."

It is with strength of this type—the strength determined not merely by climatic conditions, though possibly varying a little from season to season—that the breeders of this country are concerned.

Further, as Red Fife appears to retain its strength wherever it is grown, it is not improbable that this variety will prove to be the progenitor of the world's strong wheats in the future. Unfortunately there are many drawbacks to its cultivation in this country, and it is doubtful whether it will ever become one of our staple varieties, except possibly in some few localities. On many soils it is an indifferent cropper, and even in those places in which it gives a satisfactory yield the straw does not stand as well as that of our common wheats. Could the breeder only combine its excellent quality of grain with a heavy cropping capacity and stiff straw he would obtain a variety which would go far towards making wheat once again the most profitable crop of the farm.

The solution of such a problem requires a knowledge of the inheritance of characteristics peculiarly difficult to deal with. A casual inspection of a plant is sufficient to determine whether it is bearded, velvet-chaffed, red, &c., but strength, yield, and stiffness of straw cannot be determined so readily. In fact, the single plants the breeder now deals with—instead of the mass, as before—give him no information of value as to capacity to afford a heavy yield of grain or stiff straw. Such features can only be determined by actual and, in view of their number, costly field trials. In the characteristic "strength" the problem is not quite so complex, as by choosing varieties showing extremes of strength and weakness as parents, it is possible to differentiate these with sufficient accuracy for technical purposes when segregation has occurred.

The mode of inheritance of strength was first determined by crossing Red Fife with Rough Chaff, the former parent having strong grain of a red colour, the latter weak grain of a white colour. Like most weak wheats, the grain of Rough Chaff is soft and of a texture well described as floury, whilst that of Fife is hard and translucent. The texture of the grain has proved singularly constant under our experimental conditions and a good index as to the baking quality of flour from the grain. The generation raised from the plant arising from this combination of the parents, the F_2 of the Mendelians, showed obvious segregation into strong and weak wheats, these characteristics being entirely independent of such others as the velvet nature of the chaff, the grain colour, &c. Thus in this generation the following obvious types occurred :—

Strong, velvet-chaffed, red.	Weak, velvet-chaffed, red.
Strong, velvet-chaffed, white.	Weak, velvet-chaffed, white.
Strong, smooth-chaffed, red.	Weak, smooth-chaffed, red.
Strong, smooth-chaffed, white.	Weak, smooth-chaffed, white.

On determining the proportion of strong-grained to weak-grained individuals there were found to be three of the former

present to every one of the latter, the distribution of the two forms being uniform in the eight types mentioned above. Strength in this case, then, proved to be simply dominant to lack of strength. In the following season a number of pure strong types were isolated and grown on again the following year, in order to obtain sufficient grain for tests in the bakehouse. The results of these tests confirmed the view arrived at from an examination of the grain of the $F._2$ generation, and left no doubt that the strength of these hybrids was of the same order as that of the parent Red Fife.

In many other cases the simple Mendelian ratios are not so readily ascertainable, owing to the varieties chosen as the weak parents producing semi-translucent grain. Under such conditions the well-known chewing test of the wheat buyer is generally sufficient to show that segregation has occurred, and to enable the breeder to pick out the strong types for further tests.

Whilst these investigations were in progress some of the late W. Farrer's Fife crosses were being obtained in sufficient bulk for baking tests. These also proved to be "fully as strong as Fife." Thus the facts at our disposal seem to warrant the statement that strength is a unit character. Complications may and probably do exist, much as they do with the colour characteristics of wheat, but of this nothing is known at present; so far the only exception taken to this view has been based on cases in which the actual baking strength of the parent plants is unknown.

The strong wheats of the world are at present cultivated almost exclusively in countries in which the yield per acre is small; where large yields are the rule the weaker types only are in general cultivation. It has consequently been assumed that strength and lowness of yield are correlated with one another. If this view be correct the combination of heavy yield with strength is an impossible one. At present little evidence can be brought forward from one side or the other, though it is worth noting that in some few districts in England Red Fife crops as well as Square Head's Master. Such fresh evidence as can be brought forward at this stage points, however, to the incorrectness of the general view, and seems to show that a heavy crop of good quality is by no means an impossibility.

The best proofs of its possibility or otherwise would be afforded by a detailed study of the inheritance of yielding capacity, a matter on which it must be admitted we know little at present. That it is a unit character is perhaps indicated by the fact that some varieties are consistently heavier yielders than others even under a wide range of variation in the conditions. For instance, Square Head's Master has, on this account, gradually driven such varieties as Red Lammas, Chiddam, Talavera, &c., practically out of

existence. Further, the cultivation of a long series of hybrids between heavy and comparatively low yielding wheats seems to point to segregation of these features. Exact statistics, however, are very difficult to obtain owing to the wide range of fluctuating variability in this character and the difficulty of growing plants under sufficiently uniform conditions to eliminate this. Even when the outer rows of an $F._2$ culture are neglected as consisting of obviously favoured plants, gaps, due to failures in germination or the attacks of mice, &c., give neighbouring plants a greater root range and better opportunities for development than others. In the absence of such information one has to fall back on the yields of the plots grown from the $F._2$ generation and then on the crops of succeeding years, basing conclusions as far as possible on plots of sufficient acreage to give trustworthy returns. For this purpose the Fife hybrids mentioned previously are fairly suitable, as under the conditions under which these experiments were made Fife barely yields twenty bushels to the acre, whilst Rough Chaff may be expected to give a good average yield of thirty-two bushels.

In making the selections for further cultivation these strong types, promising to give the best yield, were deliberately chosen. Some forty of these, which have been tested in plots varying from one-quarter to three acres in extent, have given in each case yields of the same order as the parent Rough Chaff and over 50 per cent. greater than Red Fife on the same farm. On other soils some grown on the large scale have produced crops of forty-two to forty-four bushels, but in these cases the cropping capacity of Rough Chaff is unknown, though Fife is known to be a failure as regards yield. The evidence for the segregation of high and low yields is by no means final, but it is sufficient to show that high yields of good quality are not unobtainable.

The question of heavy yields per acre is intimately connected with the power of resisting the various diseases to which the wheat crop is liable, as no plant crippled by the attacks of a parasite can be expected to yield its full quantity of grain. It is a well-known fact that if a large number of varieties of any plant grown under the same conditions are exposed to the same chances of infection they show marked differences in the extent to which they become attacked by various parasites. This is well shown in the case of wheats and the various rusts which live upon them. In fact, it has now become part of the routine work of many experimental stations to collect and grow as many varieties as possible, with the view of selecting the most immune types for local cultivation. In our earlier tests several varieties were found showing an extraordinary power of resisting the attacks of the common yellow rust, *Puccinia glumarum*. Even in years when

the rust attack has been at its worst they have shown only the merest traces of infection. Such immune varieties were at once crossed both with moderately and with extremely susceptible varieties to determine whether the power of resisting disease would prove a unit character. In each case the hybrid plant proved susceptible to yellow rust, whilst its offspring consisted of immune and susceptible forms in the proportion of one of the former to three of the latter. In the many cases examined the segregation has proved to be exceedingly sharp. The property of resisting the attacks of yellow rust is thus shown to be a Mendelian recessive, and consequently all extracted immunes should breed true to this feature in succeeding generations. This point has now been tested many times, with concordant results in all cases. Further, the experiments have shown that immunity is independent of any recognisable morphological characters. Thus in the case of yellow rust there appears to be no valid reason why the plant breeder should not mitigate the evils of its attacks by using this knowledge as a basis for the production of resistant varieties. The attempts already made seem to show conclusively that this is practical. One example must suffice. From a cross between Square Head's Master and a resistant variety found in Russian Ghirka wheat two very promising wheats, one immune and one susceptible, were isolated and grown on for comparison. In 1909, a moderately bad rust year, three-acre plots of these varieties were grown alongside one another. The susceptible variety gave one of the most striking plots of wheat on the experimental farm; the immune variety also grew into a good crop, though farmers visiting the station almost invariably preferred the former, in spite of its rustiness. At thrashing time, however, the effects of the attack became obvious, as the susceptible variety only yielded some forty-two bushels of grain per acre, as compared with fifty-four bushels per acre from the immune variety. The grain of the former was also so shrivelled that it was only fit for chicken food, whilst from the latter less than a half per cent. could be screened when dressing it for seed.

If the attacks of yellow rust can be controlled in this manner it is reasonable to suppose that the still more serious black rust (*Puccinia graminis*) can also be brought under control. At the present time the most that can be said is that some evidence pointing in this direction has been obtained. The problem will, however, have to be solved elsewhere, for even with plantations of the alternative host, the Barberry, in the vicinity of the trial plots, we cannot count on a yearly epidemic of this rust to test the varieties thoroughly.

IV.

WHEAT BREEDING IN CANADA.

By CHARLES E. SAUNDERS, Ph.D., Cerealist of the Dominion Experimental Farms.

On account of the vast extent and the varied climatic conditions of Canada, it is necessary to mention briefly the six chief sections into which the country may be divided on the basis of its wheat production.

I. *The Maritime Provinces: Nova Scotia, Prince Edward Island, and New Brunswick.*—In these large tracts of country not very much wheat is grown. Most of the grain is sown in the spring, and the yields obtained are usually good, the kernels being plump, but rather soft and starchy.

II. *Quebec and Northern Ontario.*—Spring wheat rather than winter wheat is usually grown, although the total quantity produced is not very great considering the numerical strength of the farming population. The kernels of the spring wheat produced in this section of Canada are usually somewhat smaller and harder than those grown in the Maritime Provinces. When the varieties which yield the strongest flour are sown, the wheat from this area is scarcely surpassed by that grown in any other part of Canada, though in appearance it is usually less attractive than the grain from the Western prairies.

III. *Southern Ontario.*—The mild winter and the rather hot and dry summer make the conditions in this region more favourable to winter wheat than to spring wheat. Most of the sowing is therefore done in the autumn, September and October being the favourite months. The winter wheat of Southern Ontario is typically large, plump, and quite starchy. When spring wheat is sown a variety of durum wheat known in Canada as "Goose" or "Wild Goose" is often used because it gives a better yield than the ordinary varieties used for bread-making. Goose wheat is used chiefly for feeding purposes or for the manufacture of macaroni.

IV. *Manitoba, Saskatchewan, and the Northern and Central Parts of Alberta.*—This enormous tract of country is devoted very largely to the cultivation of spring wheat, which, as a rule, gives a good yield and produces kernels of a hard, glutinous character scarcely to be surpassed. Winter wheat has been tried in some sections, but has not proved uniformly successful.

V. *Southern Alberta.*—Winter wheat has been profitably grown for many years in the south-western portion of Alberta, and the area devoted to it of late has been largely extended northwards and eastward. Spring wheat is also grown in this portion of the Province, but to a smaller extent than winter wheat. The

yield per acre of winter wheat is usually large, and the kernels are exceptionally heavy and hard.

VI. *British Columbia.*—This Province does not produce very much wheat, though it is found profitable where grown. Both winter and spring varieties are sown. The diversity of climates in this Province is so great as to render impossible any general descriptive remarks on the subject.

From the details just given it will be readily seen that the position of winter wheat in Canada is distinctly subordinate to that of spring wheat. In order therefore to bring the subject within reasonable limits all discussion of the work which has been done in this country with winter wheat is omitted.

Most of the breeding and selecting of varieties of wheat in connection with the Dominion Experimental Farm system has been carried on at the Central Farm at Ottawa, where the climate in many respects resembles that of most of the spring wheat districts of Canada. The selections made at the Ottawa Farm are only provisional; the most promising varieties are afterwards sent to the various branch farms for further trial and for the rejection of any found unsuited to the local conditions.

When the Dominion Experimental Farms were first established the settlement of the great prairie country of Central and Western Canada had not progressed very far, so that there were various problems of vital importance connected with the growing of wheat on the plains which awaited investigation. While, therefore, the needs of the older farming districts have not been overlooked, the most interesting branches of the work have been those concerning the great wheat-growing plains. The short summer of the prairies emphasised the need for early-maturing varieties of wheat, while the long distance between the farmer and the main centres of wheat consumption made it essential that only such varieties should be grown as would command an exceptionally high price in the world's markets, so that the cost of transporting the grain would be relatively low.

The prairie settlers found the famous Red Fife wheat very satisfactory on the whole, except in regard to the time taken to mature the crop, which in the less favourable seasons was rather too long; so that the fields were sometimes touched with frost before the grain was ready to be cut, thus very seriously lessening the farmers' income. In hardness of kernel and in flour strength (the characteristics which perhaps chiefly determine the selling price of any wheat) this variety ranks at the head of its class. What was needed, therefore, for the great wheat-growing plains was an early Red Fife: a variety having all the good qualities of ordinary Red Fife with the added excellence of earliness.

To meet this need, early-ripening varieties of wheat were

imported from various countries by the Director of the Experimental Farms, and at as early a date as possible experiments in cross-breeding were begun for the purpose of combining in one sort all the desired qualities. Naturally, Red Fife was used as one of the parents in the majority of the crosses which were effected, as this wheat perhaps possesses more good points than any other well-known kind from a commercial point of view.

None of the early wheats imported from other countries proved satisfactory for our conditions, although some of them have been found of great value in cross-breeding. The new and improved varieties which have been or are being given to the public have therefore been produced either by cross-breeding (followed by selection) or by the mere selection of superior strains from existing sorts. Both of these lines of work have given valuable results, though selection alone has been found to be limited in its practical possibilities.

The work of cross-breeding was begun by Dr. Wm. Saunders (the Director of the Experimental Farms) and his assistants in the year 1888. The principal crosses which were made at that time were between Red Fife wheat (or White Fife, an almost identical sort) and an early-ripening variety which had been obtained from Russia. Some years later other crosses were effected, but the main interest has centred in the progeny of the first crosses, especially those known as Stanley, Preston, and Huron, which are now widely distributed throughout the western provinces and which have contributed largely to successful wheat-growing in many of the less-favoured localities during the past few years.

In the earlier years the system of selection after crossing was not so thorough as that now known to be necessary. The cross-bred varieties first introduced were therefore not quite fixed in some essential respects; and it devolved on the writer of this Paper, who was appointed in the year 1903 to take charge of the work with cereals, to re-select all the varieties of wheat obtained from the crosses effected up to that time. By this re-selection, on Mendelian lines, of course the early cross-bred wheats have been distinctly improved; the best of the new, selected strains combine to a very large extent the good qualities of both parents. Stanley, Preston, and Huron, as now grown at the experimental farms, are vigorous, early sorts, ripening a few days—or sometimes nearly two weeks—before Red Fife, and having hard, bright kernels of the popular reddish-brown shade. In yield of grain per acre they often surpass Red Fife, even when the conditions are favourable to the latter sort, and in yield of flour in the mill they are quite satisfactory. From a commercial point of view they are all somewhat inferior to Red Fife, for while they produce flour of good quality it does not usually possess the remarkable baking

strength which generally characterises Red Fife flour. Preston and Huron have a further but not very serious disadvantage of yielding flour of a deeper yellowish colour than that made from Red Fife. Stanley gives flour of the same shade as Red Fife.

In addition to the three new varieties just mentioned, which inherited their early-maturing qualities from a wheat from Northern Russia, reference should be made to three other cross-bred sorts, Marquis, Chelsea, and Bishop, which owe their earliness largely to the fact that one of the parents in each case was a very early wheat obtained from India. Marquis and Chelsea are descended in part from Red Fife. Bishop is an Indo-Russian cross. Of these newer varieties Marquis is perhaps the most important, showing distinct superiority over the cross-bred varieties first introduced in regard to the character of the flour, which both in strength and in colour is practically identical with Red Fife. Comparative baking tests carried on last winter with samples from the crop of 1908 showed that Marquis grown at Brandon, Manitoba, was equal in colour and strength of flour to Red Fife grown on the same farm and was superior to Red Fife grown at Indian Head, Saskatchewan. The differences observed were not very great, and might perhaps be reversed another season; but the high strength of Marquis is fully established by these and previous tests. Marquis is a beardless wheat having hard red kernels, and resembling Red Fife in all respects, except that it is earlier in ripening. It ripens about with Stanley, Preston, and Huron.

Chelsea is a very early, beardless wheat, satisfactory in all respects except flour strength, in regard to which it ranks about with Stanley and Preston. It closely resembles the new, selected strain of Stanley, but seems to be earlier and perhaps more productive than that variety.

Bishop is a still earlier wheat, possessing many good qualities, its remarkable productiveness being of special interest. It gives a rich-looking, yellowish flour of good strength, but not equal to the strongest varieties. In spite of its many admirable qualities the fact that it possesses a pale, yellowish skin prevents us from advising farmers to grow it for export; the Canadian grain inspection laws are based on the idea that wheats with a pale skin are usually of inferior quality and the regulations in regard to the grading are so worded as to make it practically impossible for any farmer to obtain a fair price for a yellow (or so-called "white") wheat in what is known as the Manitoba Inspection Division. Bishop has succeeded remarkably well at almost all points where it has been tested. As an instance of special interest I may mention that a large yield per acre of grain weighing 65 lbs. to the measured bushel was obtained from this variety

last season at Lesser Slave Lake in a latitude about 400 miles farther north than Winnipeg. No doubt it will succeed very well much farther north than this.

These new varieties and new strains of the older sorts are now being propagated for free distribution. Most of them were available to a limited extent for that purpose last winter. At present it appears that Marquis may take the lead as the best for export purposes of all the early sorts yet introduced, unless the selected form of Red Fife, mentioned later in this Paper, should prove equally early. These two varieties are very much alike, though of quite distinct origin.

In addition to the six varieties of wheat mentioned by name, which have all sprung from crosses made in the earlier years of the existence of the experimental farms, we have now on hand a large number of very promising varieties which have been produced from crosses made by the writer in more recent years. About 200 of these new sorts are now being propagated for further test, and will probably soon be followed by several hundred others, from the progeny of the most recent crosses which at the present time are not quite fixed in type. Of course, it is not intended to retain more than a few new varieties adapted to the various conditions of soil and climate in Canada. The task of eliminating the less desirable sorts will therefore be rather lengthy and difficult, especially as the baking strength of the flour must be considered in nearly all cases.

When this work was commenced, the strength of the flour from any wheat could not be determined until a large quantity of grain was available, and even then we were dependent on the mere opinion of some commercial baker, not usually a trained scientist, as to the characteristics and value of the flour. Now, however, with the introduction of the small experimental flour mill and the development of a scientific method of determining baking strength, this matter can be investigated much earlier in the history of each variety; the conclusions reached are far more trustworthy than before. All new varieties intended for bread making are tested in the baking laboratory before being distributed. In addition to the final baking tests I have used for several years a simple chewing test (taking only a few kernels of wheat) as a valuable guide to gluten strength and probable baking strength in the earlier stages of selection. This test was advocated as an essential aid in the selection of cross-bred varieties of wheat in the Bulletin on Quality in Wheat, published at Ottawa, October, 1907.

Results of considerable practical importance have already followed the introduction of these early maturing wheats, since they can be depended upon to ripen in some districts where the

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old standard variety Red Fife is often caught by frost. By the use of these earlier kinds the areas of profitable wheat culture have been extended. Furthermore, a small acreage of some of the new sorts may be advantageously sown, especially on stubble land, even in districts where Red Fife succeeds fairly well, so as to lengthen the harvesting season when labour is scarce; with the possible exception of Marquis, however, none of the new cross-bred sorts thus far introduced can be recommended in place of Red Fife in localities where that variety can usually be ripened.

As an instructive proof of the value of early-maturing wheats some results obtained last season on the experimental farm at Lacombe in Central Alberta may be cited. All the spring wheat on that farm was somewhat blemished by frost with the exception of one very early variety, Downy Riga, which was cut before the first frost. The kernels were plump and bright with a smooth skin, and weighed 63½ lbs. to the measured bushel. Huron, a little less early, was still so well advanced at the time of the frost that the kernels when threshed were plump and weighed 62 lbs. to the measured bushel. The bran, however, was so much roughened by the frost that the wheat would have been graded quite low if offered for sale. Red Fife from the same series of plots was very seriously damaged by the frost, the kernels being rather shrivelled and the bran somewhat rough. The weight of a measured bushel was only 58½ lbs.; the yield 18 bushels per acre. Downy Riga gave 31 bushels, and Huron 37½ bushels per acre.

While the results achieved thus far are of great value, still further advances are expected in the near future. Some of the new, hard, red, early wheats derived from the writer's recent crosses are to be ground and baked during the coming winter; it is expected that from fifty to a hundred new sorts will be tested in this way every year for several years to come. Out of this large number we may confidently look forward to the discovery of at least a few varieties which will surpass any of those yet known by combining all the good qualities needed in an early maturing wheat for export.

Though cross-breeding is essential for the production of new varieties of wheat radically distinct from any existing sorts, one may occasionally isolate by mere selection some fairly distinct type (a "sport" or a "mutant") superior in certain respects to the variety from which it was selected. A considerable amount of selection has been carried on at Ottawa, and one at least of the new strains discovered promises to be of importance and ranks in interest with the cross-bred sorts. This is a strain of Red Fife wheat originated from a single early maturing plant found by the writer in 1903. This strain has been thoroughly tested both

in the field and in the baking laboratory, and has been proved to be genuine Red Fife in all essential respects. It ripens earlier and shows certain other minor points of difference, but would be generally recognised as Red Fife. This wheat has now been grown for six years at Ottawa and was tested during the present season at Brandon also; it is a strong grower and promises well. Its advantage in earliness over common Red Fife is only a few days under ordinary conditions; by no means sufficient to meet the needs of all districts, but quite enough to establish its value and to create a large demand for it. It has been named Early Red Fife, and will, it is expected, be available for general distribution in small quantities after the next harvest.

It would be quite in accord with popular ideas if we were to carry on repeated selections of Early Red Fife for earliness through several years or decades, in the hope of obtaining still further advances in that direction. Unfortunately there are good grounds for believing that the further advances would "tease the patience of the centuries" before any striking results would be obtained. Early Red Fife did not, in all probability, acquire its earliness by degrees but at one step, at the same time as its other points of difference from the parent variety were manifested. In introducing this variety I do not claim that I have *improved* Red Fife wheat, but that I have discovered and isolated an improved type which had previously been mixed with the ordinary form. It is from cross-breeding followed by selection that one may expect the greatest advances in the direction of any desired change; and it is to cross-bred varieties therefore that we must look for still earlier wheats of high baking strength.

We may now turn to some of the observations of a scientific character which have been made during the progress of this work.

In regard to the inheritance of awns I wish merely to repeat my view that awns and the absence of awns do not necessarily form a pair of Mendelian unit characters, but that an intermediate condition is quite common (in wheats of cross-bred origin) in the first generation and also in succeeding generations. It has been asserted that strength and weakness of flour form a pair of Mendelian unit characters. Even after making all due allowance for the necessarily somewhat indefinite meaning of the words *strong* and *weak*, the writer finds it impossible to accept this view. (See *Journal of Agricultural Science*, vol. iii., p. 218.)

Among other irregularities in inheritance, two may be mentioned which occur so frequently as to suggest that they may perhaps be *regularities* after all. When two varieties of wheat having reddish bran are crossed, it often occurs that in the second and later generations some of the progeny have yellowish bran. In regard to awns a somewhat similar phenomenon is often observed,

namely, the appearance in the second and later generations of fully bearded plants, both the parent varieties having been practically awnless. In such cases I have never witnessed the production of intermediate or half-bearded types which are so common when bearded and beardless sorts are crossed. Perhaps the occasional production of downy chaff when two varieties with smooth chaff have been crossed may also belong to this same category, though it appears to be less common.

V.

THE INFLUENCE OF GOOD SEED IN WHEAT PRODUCTION.

By C. A. ZAVITZ, Professor of Field Husbandry, Agricultural College, Guelph, Ont.

That good seed is at the very foundation of good farming is as true in the case of wheat as it is in that of any other farm crop; seed is therefore occupying the attention of investigators throughout the world. When we realise that about 11 per cent. of all the wheat grown, amounting to fully 300 million bushels, is used annually for seed, we can understand something of the great importance of the problems.

A considerable amount of attention has been paid to the study of the seed of various classes of farm crops, including wheat, at the Agricultural College, Guelph, Ontario, during the past twenty years, but more particularly during the past ten years. Both winter wheats and spring wheats are grown in the province, the former the more extensively. The grain of the common wheats is principally used for the manufacture of bread, of pastry, and of breakfast foods; that of the durum, or the macaroni wheats, for flour to mix with that of the softer winter wheats and for export to other countries; and the Emmer as feed for farm stock. This Paper will be confined almost entirely to results of experiments conducted at the Ontario Agricultural College on the seed of the common wheat (*Triticum vulgare*).

About fifty acres of land, divided into upwards of two thousand plots, are used for experiments with farm crops. The grounds have a gentle slope towards the south-west; the soil is an average clay loam. A four years' rotation, consisting of grain, cultivated crops, grain and pasture, is adopted. Twenty tons of farmyard manure per acre are applied once every four years before the cultivated crops are grown. No commercial fertilisers are used except in distinct fertiliser experiments, to which only a small number of plots is devoted each year. The plots vary in size, according to the requirements of the different experiments; the yields per acre are determined from the actual yields of the plots in every instance. All of the experiments are conducted for at

least five years; many of them are continued for a much longer period of time.

Varieties of Common Wheat (Triticum vulgare).

Three hundred and seventy-three varieties of wheat have been tested for at least five years. Those which have made high records at the College have also given good returns in the co-operative experiments conducted throughout Ontario on hundreds, and even thousands, of farms. It is interesting to note that those varieties which took the lead in the experiments at the College, and were distributed for the co-operative experiments several years ago, are the most extensively grown varieties in the province at the present time. Other varieties of high quality are now being used both for distribution and as foundation material for plant breeding.

When tested under uniform conditions of soil and climate, it is found that certain wheats are particularly strong in some respects and comparatively weak in others. In order to secure a wheat best suited for the locality in which it is to be grown, it is necessary to have a proper blending of such valuable characteristics as strength of straw, yield per acre, quality of grain, &c. The differences in the varieties are shown in Table 1, giving the average results of twelve varieties of winter wheat and twelve of spring wheat which have been tested at the Ontario Agricultural College for several years in succession. The varieties selected in each class are those which have given the largest average yields of grain per acre, as determined on the experimental plots.

Dawson's Golden Chaff stands highest in average yield of grain per acre of the fifteen varieties of winter wheat tested in each of fourteen years. It produces a very stiff straw of medium length, beardless heads with red chaff and white grain somewhat soft, but slightly over the standard in weight per measured bushel. The Early Genesee Giant furnishes a straw of medium length and of fair strength, a short, compact, bearded head, and a grain of fairly good quality. The Imperial Amber produces a large amount of straw which is somewhat weak, a bearded head, red chaff, and a red grain of average quality. The Geneva, the Tasmania Red, and the Turkey Red varieties yield about ten bushels per acre per annum less than the Dawson's Golden Chaff and possess comparatively weak straw, but the grain is hard, weighs well per measured bushel, and produces large loaves of bread of good texture. The Crimean Red variety of winter wheat, which has been imported more recently, surpasses the Turkey Red in both yield and quality of grain, but the Crimean Red is even weaker in the straw than the Turkey Red.

Minnesota No. 163 occupies the highest place in yield of grain per acre among the varieties of spring wheat tested at the College

Average Results of Each of Twelve Varieties of Winter Wheat.

Varieties.	Bearded or Beardless Heads.	White or Red Chaff.	White or Red Grain.	Per cent. of Rust, 6 years.	Per cent. of Crop Lodged, 6 Years.	Comparative Hardness of Grain, 3 Years.	Pounds per Measured Bushel, 13 Years.	Yields per Acre, 14 Years.	
								Straw.	Grain.
								Tons.	Bushels.
Dawson's Golden Chaff	Ba	R	W	7	0	65	60·2	3·2	54·8
Early Genesee Giant .	Be	R	W	10	11	72	60·4	3·3	50·4
Imperial Amber . .	Be	R	R	6	16	72	61·1	3·4	49·6
Russian Amber . .	Be	W	R	7	7	72	61·3	3·4	48·9
Egyptian Amber. .	Be	W	R	7	7	69	61·7	3·4	48·4
Early Red Clawson .	Ba	R	R	7	12	69	59·4	3·0	48·1
Rudy	Be	W	R	7	10	76	61·3	2·8	46·4
Geneva	Be	W	R	8	18	79	62·5	3·1	45·1
Tasmania Red . .	Be	R	R	7	18	88	61·9	3·1	44·7
Turkey Red . .	Be	W	R	8	10	98	61·6	2·9	44·7
Kentucky Giant . .	Be	W	R	7	9	83	61·5	3·0	44·7
Treadwell	Be	W	W	5	6	71	60·9	3·0	44·6

Average Results of Each of Twelve Varieties of Spring Wheat.

Varieties.	Bearded or Beardless Heads.	White or Red Chaff.	White or Red Grain.	Inches in Height, 5 Years.	Per cent. of Rust, 5 Years.	Days to Reach Maturity, 5 Yrs.	Pounds per Measured Bushel, 5 Years.	Yield per Acre, 5 Years,	
								Straw.	Grain.
								Tons.	Bushels.
Minnesota No. 163 ...	Ba	W	R	46	6	121	58·9	2·2	34·1
Hungarian Red	Be	R	R	41	5	116	62·1	2·1	33·5
Climax	Be	W	R	47	6	119	59·1	2·1	31·9
Carleton	Be	W	R	47	9	120	59·3	2·2	31·4
Red Fife	Ba	W	R	45	8	120	58·2	2·1	31·3
Saxonka	Be	W	R	46	6	119	59·8	2·0	31·2
White Russian	Ba	W	R	43	9	121	58·0	1·9	31·0
Blue Democrat	Be	W	R	46	9	119	58·9	2·1	30·8
Preston	Be	R	R	43	10	115	59·1	1·8	30·8
Wellman Fife	Ba	W	R	45	11	120	57·5	2·1	30·5
Kolben	Ba	W	R	44	7	121	59·2	2·0	30·1
Herison Bearded ...	Be	R	R	43	7	118	61·8	2·0	30·1

Ba = beardless. Be = bearded.

TABLE I.

for five years. Its grain weighs rather light per measured bushel, but has given very good results in bread-making. The Hungarian Red variety of spring wheat, which has surpassed the Red Fife by an average of 2·2 bushels of grain per acre and by 3·9 lb. in weight of grain per measured bushel, has also been superior to the Ontario-grown Red Fife for bread, and has reached maturity four days earlier. The Hungarian Red wheat was imported by the Ontario Agricultural College from the Argentine Republic in the spring of 1903. It was distributed along with Red Fife throughout Ontario in the spring of 1908 for co-operative

experiments, and proved to be superior to Red Fife both in yield of grain and straw per acre and in popularity with the experimenters. It certainly shows some strong features as foundation stock for plant breeding.

Selection of Seed.

Within the past fourteen years a large amount of experimental work has been done to determine the influence of different selections of seed upon the resulting crop. For the wheat experiments, fresh seed was taken each year from the general crop of grain grown in the large fields. The results therefore represent simply the one year's influence from seed selection, but the experiments were repeated from season to season so as to secure a good average of conditions of soil, temperature and rainfall. For the large sample, none but well-developed seeds were selected; for the small sample, none but sound, plump, and comparatively good seeds of small size were used; for the shrunken sample, none but shrunken grains of good size were selected; and for the broken sample, none but seeds which had been broken by the threshing machine were included. The selections were made with great care by the use of sieves and then by hand-picking the seeds. A quantity of the large, plump grains sufficient to sow a plot twenty-five links square was carefully weighed out and the grains were then counted. A corresponding number was then taken of the small, the plump, the shrunken, and the broken seeds. The different lots were sown upon plots made as uniform as possible. The following table gives the average results obtained from the various selections of both winter wheat and spring wheat :—

Crop.	Average Annual Yield of Grain per Acre (Bushels).				
	Number of Years Tested.	Large Seed.	Small Seed.	Shrunken Seed.	Broken Seed.
Winter wheat .	6	46·9	40·4	39·1	9·3
Spring wheat .	8	21·7	18·0	16·7	—

The results of the twelve separate tests made at the Ontario Agricultural College with winter wheat show an average increase in yield of grain per acre of 6·5 bushels from large, as compared with small seed; of 7·8 bushels from plump, as compared with shrunken seed; and of 35·6 bushels from sound, as compared with broken seed; in sixteen separate tests with spring wheat, of 3·7 bushels from large, as compared with small seed; and of 5 bushels from plump, as compared with shrunken seed.

In the average of five years' experiments with winter wheat, seed which was allowed to become thoroughly ripened before it

was cut produced a greater yield of both grain and straw and a heavier weight of grain per measured bushel than that produced from grain cut at any one of four earlier stages of maturity.

Occasionally in Ontario the rains are so abundant at the time of harvesting the wheat crop that the grain becomes sprouted more or less in the shock or even before it has been cut. As the crop dries, germination is checked and the grain hardens. It is often a question as to whether such grain which has thus started to germinate is as valuable for seed purposes as that which was secured without becoming sprouted. In each of two different years very careful germination tests were made at the College of winter wheat which was out during wet weather and which became more or less sprouted. Several varieties were used each year. The average percentages of germination were as follows: Seed which showed no outward sign of germination, 94; seed slightly sprouted, 76; seed considerably sprouted, 30; and seed badly sprouted, 18. It will therefore be seen that sprouting injures the grain a great deal for seed purposes. When the grains are badly sprouted, fully four-fifths of them decay in the ground; those which do germinate afford very uneven plants.

From the results of experiments here presented in the selection of seed, we see clearly the advantage of sowing large, plump, sound, well-matured seed of strong vitality if the best results are to be obtained.

The Improvement of Wheat by Systematic Selection and by Cross-fertilisation.

A careful study of a large number of varieties of wheat for several years in succession furnishes excellent foundation stock for work in plant breeding. For a number of years past, particularly since 1902, a considerable amount of work has been done at the Ontario Agricultural College in the hope of improving some of the best varieties of wheat through selection and through cross-fertilisation. Selections have been made of the Dawson's Golden Chaff, Imperial Amber, Bulgarian and Turkey Red varieties of winter wheat and of the Red Fife variety of spring wheat. Some of these selections have been made by using choice heads obtained from the large fields, others by using superior plants obtained from about nine thousand plants of each variety, the seed of which was planted in rows one foot apart, the plants being one link apart in the rows. For sowing in rows the following year, the best quality of seed from the selected plants was used. The seed from those strains which produced the best results in the rows was used for both rows and small plots in the year following. In the next year, the seed of strains giving the best results both in the rows and in the small plots was sown in rows, in small

plots and in larger plots, so that the results of the new strains could be compared with those of the standard varieties. We have thus been able to obtain strains giving larger yields of grain of better quality than the original varieties. Especially has this been true with Dawson's Golden Chaff, the Bulgarian, and the Turkey Red.

With the object of combining the good qualities and eliminating the undesirable characteristics of the leading varieties of wheat, work in hybridisation was started in 1902 and has been continued each year since that date. Crosses have been made between the Dawson's Golden Chaff and the Turkey Red, the Bulgarian, the Tasmania Red, the Buda Pesth, the Geneva, and the Imperial Amber varieties of winter wheat; between the Bulgarian and the Turkey Red varieties of winter wheat; between the Red Fife spring wheat and the Turkey Red winter wheat; between the Red Fife and the Herison Bearded varieties of spring wheat; and between the Red Fife spring wheat and the Wild Goose and the Medeah varieties of durum wheat. In 1909 no less than 21,365 hybrid plants of winter wheat and 32,698 hybrid plants of spring wheat were grown separately in the experimental grounds. Besides these, fifty-nine plots of winter wheat and seventeen plots of spring wheat hybrids were under test. The results obtained are exceedingly interesting and very promising. To give these results even in concise form would require a lengthy paper in itself. In connection with this work we are exceedingly grateful for the information and the inspiration of such men as Gregor Mendel, Dr. de Vries, Dr. Nillson, Prof. Bateson, Dr. Wm. Saunders, and others. The writer firmly believes that there was never a time in which the outlook for the work in plant breeding was as promising as it is at present. Good seed has a meaning far deeper and far more significant than many of us have realised in the past.

VI.

INDIVIDUALITY IN PLANTS.

By L. S. KLINCK, Macdonald College, Quebec, Canada.

No two plants are exactly alike. Indeed, a close study of thousands of individuals reveals striking differences, not only between plants of the same species but even between individuals of the same variety. The majority of plants constituting improved varieties of cereals, in this country, reveal on close examination striking morphological and substantive differences.

Morphological differences are most readily noticed. Each plant in a plot of thousands may have its own individuality and still bear unmistakable evidence of belonging to the same variety.

Substantive differences, on the other hand, are more subtle. In individual plants these qualities cannot be measured, weighed, or accurately determined. Knowledge of correlations may be of service in helping to arrive at a decision, but the ability of a plant to transmit its characters must be the final test. The closest study of the physical characters of a number of plants, with a view to securing uniformity in general conformation, will come far short of enabling the breeder to determine the projected efficiency of the individuals under consideration. Such information can be obtained only by testing separately the progeny of each plant under conditions as nearly uniform as possible.

For this purpose the centgener system was devised—a system which renders possible the testing of a large number of mother plants whereby a record of the performance of each plant is obtained. The plant is the unit of selection. The centgener is a trial plot of one hundred grains planted from the product of a single mother.

A prime requisite in planting a foundation bed from which mothers are to be selected is to have all the plants grown under conditions as nearly the same as possible. To secure this equality of opportunity, so far as external conditions can be controlled, carefully chosen grains taken from hand-selected heads of the most promising varieties are planted in foundation beds four inches apart each way. The plants resulting from this seeding are pulled and studied separately in the field at harvest time, and are subsequently subjected to a more severe test in the laboratory. So rigorous is this selection, based on the physical characters of the plants, that not more than one in five hundred is considered eligible for trial in the centgeners. The same fundamental tests are applied to the centgeners as were applied the previous year to the individual plants in the foundation beds. This reduces the number eligible for registration to one in one thousand, and frequently this proportion cannot be had. Full notes are taken on the centgeners in the field, and the next season multiplying plots are sown broadcast from those centgeners which have the best performance record. In the fifth year the product of the multiplying plots enters into competition with the original variety. If, in this contest, it proves superior to the original stock it will be multiplied on the general farm as rapidly as possible and sold to the farmers at a reasonable price.

In our work so far, numerous variations, some desirable and many undesirable, have been isolated from the 550,000 plants studied during the past three years. The progeny of many of these mothers has differed widely from the parent plant and consequently from each other; the progeny of each mother from the best plants has always been remarkably uniform within itself, and,

with few exceptions, which we have not as yet proven to our satisfaction, has come true in the multiplying plots. In well-established varieties of oats of known breeding and purity, some strains have been isolated which ripened two weeks before others, and equally striking differences have been observed and perpetuated. This holds true under practically every heading under which oats are judged in the field or in the laboratory. Even among the most productive individuals the range in yield is surprising, the area covered in the third generation from one kernel of Joanette oats in one case being 127·78 square feet, and in the other 0·89 square foot, one 144 times the other. The latter, in addition to being a very low-yielding strain, was also very poor in quality.

While equally striking differences have not been discovered in wheat, barley, emmer, spelt, peas, soy beans, or corn, the range has been remarkably wide in all of these classes. The purest strain of Mensury barley obtainable has yielded a number of distinct types with widely different characters, which have so far given every evidence of high yield and fixity of type. The outstanding point, which even the most casual observer never fails to note, is the remarkable uniformity which characterises the different strains, while length of straw, time of ripening, and general conformation make their appeal to the eye of the cerealist.

From our work we are not prepared to say that this remarkable uniformity will continue. Sufficient work has been done to direct attention to the need of a more careful study of the individuality of plants and to emphasise the still more important point that this range is as wide in the projected efficiency of the plants as it is in the morphological differences. It may also be of service in drawing attention to the necessity of obtaining fuller knowledge of the parentage of plants mated before breeding is undertaken by crossing or by hybridising.

VII.

QUALITY IN WHEATEN FLOUR.

By A. E. HUMPHRIES.

Good quality is an outcome of excellence in several respects; these have been stated to be strength, colour, flavour. This list, however, should be extended to cover at least five qualities, as the term "strength" frequently includes (*a*) "stability," which should be taken to indicate the facility with which large masses of dough can be handled in the bakehouse; (*b*) the capacity for making a large quantity of bread from a given weight of flour; (*c*) the size and shape of loaf.

These subdivisions of "strength" should be regarded as

essentially different characteristics, frequently combined in the same flour but in reality independent units of quality. Strength should be defined as "the capacity for making large, shapely, and, therefore, well-aerated loaves." High dietetic value is the result of the proper combination of various qualities and need not therefore be specified as a separate characteristic.

It should be remembered that in the economy of Nature wheat is a seed. The true function of the husk is to protect the food of the plantlet, and it therefore resists disintegration and can be found in existence in the ground six or nine months after planting. The endosperm or kernel is converted by the action of enzymes, operating on a damp or wet pabulum, into the food of the plantlet until the latter is able to get its sustenance from soil and air. These agents and operations have to be controlled or influenced by the miller and baker when wheats and wheaten flour are diverted from their natural functions to use as food for man.

Flavour.—If an extremely small proportion of diastase—say 0·02 per cent. of absolute diastase or its equivalent in the malt extracts of commerce—be added to flour in milling or in baking, a very perceptible improvement in flavour is produced. If sugar itself be added, its effect on flavour is either nil or harmful. It seems, therefore, that the improvement in flavour due to the addition of diastase is caused by the production in fermentation of intermediate products of a dextrinous nature. An improvement in flavour is usually or frequently correlated with an increased moistness of the bread. The water-retaining capacity of dextrinous matter is well known. One charge against modern milling is that the germ of wheat is now extracted. In a Paper ("Modern Developments of Flour Milling") read before the Royal Society of Arts in 1906 the author showed that a substantial proportion of the germ was extracted by millstone milling, but a larger proportion is extracted by roller milling. The percentage of the wheat extracted as germ by either process is very small, but as a consequence enzymic action is diminished to an appreciable extent. Some harm is also done to flavour, but, on the whole, it is desirable to extract the germ. Enzymic action depends not only upon the presence of enzymes in sufficient quantity, but upon the physical state of their pabulum. The methods of milling, in particular the skilful use of water in conditioning the wheat before grinding or in the processes of grinding and separating, or even the addition of water by the miller to certain flours after milling, may materially assist enzymic action.

Colour.—Opinions differ as to whether perfection of colour implies whiteness of chalky or of creamy hue; all are agreed it should imply brightness of appearance in crumb and crust. Excellence of colour in bread cannot be measured by any absolute

colour standard. It is largely a question of optics. Refraction and reflection of light most materially affect the judgment of the observer in looking at a loaf of bread. A flour which is white or even very white but weak may make puddings of good colour, but loaves of poor dingy appearance. However, if an improved aeration be effected, either by successful treatment of the flour by the miller or baker or even by the admixture of some stronger darker flour, the resulting bread is made to appear much whiter. The causes which affect colour in flour do not seem to have been definitely determined. Modern developments of flour milling have eliminated dirt and dark fungoid contamination and in increasing degree are still diminishing the amount and intensity of friction in milling, whereby discoloration due to the pulverising of the husk is diminished. It is desirable to obtain a more thorough acquaintance with the colouring matter of wheat and flour to know with more precision what it is, how it is distributed by Nature in wheat, and what happens to it in milling.

Scientific and milling circles have been much exercised as to whether artificial bleaching of flour is due to nitrating or oxidising or to both. Chemists should consider the point why the addition of alkali turns some flours yellow, and why the addition of acid or acid salts has sometimes a whitening effect.

Cerealists and chemists might jointly consider whether it is a fact that climate materially affects the colour of wheat; for instance, whether a red-skinned wheat grown in California does in fact become white-skinned after a few seasons there, and, if so, what change has been effected in the nature and distribution in the berry of the colouring matter.

Strength (*Size and Shape of Loaf*).—In most cases a large loaf is an indication of the high gas-yielding capacity of the flour from which it is made, and is ordinarily also an indication of high diastatic power. A 2-lb. loaf measuring 3,000 c.c. is better aerated than one measuring 2,200 c.c., and is therefore more likely to be digested easily. A flour from which large shapely loaves can be made probably contains more nitrogenous matter than a weak flour, and is therefore more highly esteemed from the dietetic point of view. The effect of these considerations in the commercial world is to cause a demand for strong flours and wheats, and as ordinarily there is a larger supply of weak wheats than of strong, the latter realise a higher price than the former. It has therefore become important to ascertain the ultimate cause of strength from the chemist's point of view, also to ascertain whether the potential strength of any flour or wheat has been developed or utilised to maximum advantage. It has recently been stated or suggested that the quantity of gas given off in fermentation is either the direct cause of strength or is to be

correlated with it. That proposition is untenable. A very large proportion of the gas evolved in panary fermentation is lost, either as a result of the mechanical handling of the dough or by gradual diffusion. The leak is not the same in the cases of all flours, and it was shown at the last International Congress of Applied Chemistry (Humphries and Simpson) that the gas-retaining capacity of a set of flours indicated with substantial accuracy their relative strength. The gas-making capacity of any flour can be most materially modified by the baker or by the very latest developments of flour milling. The gas produced in the earliest stages of panary fermentation is lost so far as effective aeration of dough is concerned. All flours afford much gas in the early stages; and while some afford enough at all stages, very many do not. The total amount of gas evolved must be useless as an index of strength; for working purposes the gas evolved in the later stages of fermentation only may be used as an index. Even then any gas produced beyond what is necessary to overcome the leak and the relatively small quantity required for the inflation of the dough is wasted. It follows, therefore, that the problem before the miller or the baker is to make certain that any given flour should yield enough gas for practical working purposes whenever panary fermentation is to be taken into account.

It is obvious that the requirements of the yeast have to be considered; it must have a sufficiency of proper food. In other words, it must have sufficient sugar, soluble nitrogen, and mineral food (phosphates). An addition of sugar sometimes increases the quantity of gas evolved in panary fermentation, sometimes diminishes it. My colleague, Mr. A. G. Simpson (Humphries and Simpson—International Congress of Applied Chemistry, 1909), explained that point as follows: When a mixture of flour and water is made, a large proportion of the water goes into combination, and this proportion increases as time passes. The food of the yeast is that part of the flour which goes into solution when water is added in dough-making. The quantity of sugar found in a flour before a dough is made with it is not a correct index of the quantity which will be formed by diastatic action when water is added. The quantity so produced will depend not only upon the enzymes concerned in diastatic action, but also upon the physical state of their pabulum. It is known that yeast cannot thrive in a liquid containing sugar if the concentration of the sugar be high, and it has been ascertained that for optimum results the concentration should not exceed 15 per cent. From the foregoing considerations it will be gathered that during fermentation the proportion of water available to hold sugar in solution is diminishing, while a relatively large proportion of sugar is being produced as the result of diastatic action. It follows,

therefore, that the concentration of sugar in the uncombined water may easily get beyond the proportion at which the optimum proportion of gas can be obtained. It follows also that, in certain cases, sugar can be added advantageously when an increased production of gas is desired; it can also be added advantageously in some cases when it is desirable to retard fermentation.

It may be asked whether the same principles apply in other cases of enzymic action. Can beneficial enzymic action be assisted or undesirable enzymic action retarded on such lines? Are there any reasons for believing that conditions favourable or unfavourable to alcoholic fermentation equally affect enzymic action? Has sugar a direct effect on the physical state of the gluten?

Mr. Whymper (in the Starch Section of the last International Congress of Applied Chemistry) showed by photo-micrographs and lantern slides that only a very small proportion of the starch particles is attacked by diastase. The small or smaller grains were shown to be unaffected by the diastase. Mr. Simpson has shown that, under certain conditions, a small proportion of flour converted into sugar a quantity of ungelatinised starch equal to 8 per cent. of the weight of the flour, but that under identical conditions the same quantity of the same flour converted a quantity equal to 400 per cent. of its own weight into sugar when gelatinised starch was used. It seems, therefore, that the cellulose envelope of the starch cells is the impediment to the maximum effect of diastatic action.

These points have a direct bearing upon a point which arises in milling concerning fine *versus* coarse dressing—whether it is desirable to make a lively granular flour or a softer feeling flour consisting of much smaller particles. The latter should contain a much large proportion of fissured cells than the former.

The author has found that flours made from wheat produced in very hot, dry climates, as a rule, yield relatively small quantities of gas in panary fermentation. The starch so produced by Nature becomes so stable and so resists disintegration that in fermenting flour made from such wheats under old conditions of milling proper diastatic action is not produced; by the skilful application of water, or by adding either malt extract or proper yeast foods, or by a combination of these methods, the miller can and should produce flour capable of making better and more nutritious bread.

Four years ago the author found that if an aqueous extract of bran be added to the water used in bread-making it has a marked effect in increasing the size of loaf from certain flours, the effect being substantially the same even if the extract be boiled. After analysing this extract and adding the various constituents found therein to many flours during the processes of bread-making, he found that when sugar was added it operated in ways already

described; that absolute diastase or its equivalent in malt extract in many cases operated most beneficially; that nitrogen added in the form of more or less decomposed peptone, or better still in the form of ammonium phosphate, did a great amount of good in some cases; lastly, that the three phosphates forming almost exclusively the mineral matter of flour (phosphates of potash, magnesium, and calcium) operated very beneficially in some cases. The phosphates did good frequently, even when the gas evolved in fermentation was reduced as the result of their use; the explanation of the benefit so obtained was not forthcoming until Professor T. B. Wood showed how dilute solutions of various acids, alkalis, and salts had a very great influence on the physical characteristics of gluten.

It is desirable to ascertain whether these phosphates have a toughening effect on all flours or only in some cases; also whether it is desirable to obtain a proper balance of the three phosphates; in other words, whether it is the presence of any one in sufficient quantity which is essential, or whether all that is necessary is to secure the presence of either or all in sufficient quantity.

If the soluble extract of the entire husk of wheat be used—that which the consumer would swallow in eating wholemeal bread—the effect on the bread is bad, but if we select from the whole set of constituents those which are desirable, we obtain good and sometimes very good results.

In view of the beneficial results obtained from treatment of some flours with these phosphates experiments in manuring wheat should be made with the phosphates of potash and magnesium instead of with the sulphates, so that it may be seen whether the plant can assimilate a larger quantity of these salts than it ordinarily does, and whether an increased quantity of the salts if found in wheat so manured has any effect on the quality of the flour and in particular on the quality of the gluten. The substitution of ammonium phosphate for sulphate of ammonia or nitrate of soda should also be tested.

As a result of panary fermentation the nitrogenous matter of flour originally insoluble in water becomes soluble to a very large extent indeed. It is desirable to ascertain whether this change should be helped or retarded, and what is the optimum degree of such solubility.

Stability of Dough and Yield of Bread per Sack of Flour.—It seems at first sight that the yield of bread per sack of flour is likely to depend upon the degree of stability the dough possesses, as if a dough be particularly stable the baker should be able to handle it satisfactorily, even if he add a larger proportion of water. This is only partially true; if two flours be carefully tested there comes a point at which the maximum slackness of dough is

reached in each case, but even then one dough may be more stable than the other, may be tougher and more resilient—that is to say, substantially better than the other. The consistency of the dough has to depend not upon the percentage of water it contains but upon its stability—that is to say upon the facility with which large masses of dough can be handled in the bake-house. To get optimum results some flours should carry a relatively low and others a relatively high percentage of moisture, so that each shall produce the best results in bread. The baker is under no legal or moral obligation to the consumer to guarantee the water content of his goods, and if as a result of additional water, skilfully added, it is possible to produce better bread because it is better aerated or rendered more appetising, the addition of water needs no further justification.

It is obvious that the yield of bread per sack will depend very largely upon the quantity of water which any given flour will absorb and retain. The variable limit as to what water various flours will take will be determined by commercial practice and competition. There cannot be one uniform standard for the moisture which flours themselves should contain. The optimum figure will vary greatly according to many conditions, and can only be determined satisfactorily by the miller and his skilled advisers.

These two points of quality in wheaten flour should therefore be regarded as essentially different one from the other, although in most cases they are closely correlated. In the author's opinion each country or district should produce those wheats which return the greatest yield of wheat fit for human food. In that way the grower gets in all probability the best financial return and the public interest is best served. It is well known that in certain districts better financial returns can be obtained by the grower if he produce wheats which are not highly esteemed in commercial circles.

VIII.

THE CHEMICAL PROPERTIES OF WHEATEN FLOUR.

By Dr. E. FRANKLAND ARMSTRONG, Ph.D., D.Sc.

Wheaten flour is composed of (1) starch, (2) proteins * of several kinds and small quantities of (3) fat, (4) sugar, (5) cellulose, (6) mineral matters. In addition, air-dry flour contains from 9 to 16 per cent. of (7) moisture.

Although starch is the predominating constituent, amounting

* The term protein is the modern equivalent of the older terms proteid or albuminoid.

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to about 70 per cent., most attention has been directed to the proteins. When flour is made into a dough and the starch removed from this by agitation with water, a sticky, elastic mass of a light-brown colour remains; this is known as gluten and consists almost entirely of protein.

The definition of "strength" now generally adopted (*see* Humphries, p. 40), based as it is on the character of the final product—the loaf—covers so many factors that it cannot be strictly correlated with chemical composition. It is, however, to be supposed that the determination of certain factors or groups of factors should enable some idea of the relative baking values of flours to be gained in the laboratory; experience has confirmed this view. The chemist requires the miller and the baker to define, as precisely as possible, the particular points they look for in a satisfactory wheat or flour. Mr. Humphries has rendered great service by his attempts to do this.

In the following a brief review is given of the factors with which strength has been associated in the past. The explanation of "strength" from the chemical point of view must be treated as a separate problem.

The preparation of sample loaves from a given flour still remains the most satisfactory test. It is essential that such loaves be prepared with scientific accuracy, under definitely standardised conditions, so that the only variable is the flour itself and possibly the amount of water used for doughing. Every mill desiring to produce uniform products is bound to have a laboratory for this purpose.

Gluten.

The oldest idea is that "strength" is due to gluten; that in virtue of its elasticity this retains in the dough the gas produced during panary fermentation, and enables the dough to distend and keep up when baked. Flours containing most gluten should be the strongest. Experience has shown that a high gluten content is usually associated with strength, but in a great number of instances it has been found that of two flours, that with the higher gluten content behaves as the weaker when baked. Scientifically, therefore, gluten content cannot be considered an absolute measure of strength, although obviously connected with it.

Total Nitrogen.

Some of the proteins of flour are soluble in water, and therefore are removed during the process of washing out the gluten. The determination of total nitrogen in a flour is less liable to the errors affecting the empirical methods of estimating gluten, but the results of such determinations are roughly parallel to the gluten

content and afford no absolute measure of strength. Equally unsatisfactory is the determination of nitrogen in the dry gluten.

No doubt future work will involve the study of the forms in which nitrogen is present.

All measurements hitherto made indicate that strength depends on the *quality* rather than on the *quantity* of the proteins in flour. However, the protein content, when judging normal flours, is undoubtedly the best single measure of strength.

Quality of Gluten.

No satisfactory chemical data by which this can be gauged have been obtained. Measurements have been made, for example, of the power of expansion when a definite weight of gluten is heated in metallic cylinders to a definite temperature. Of greater significance is the water-holding capacity or *hydration ratio* as measured by the ratio of the wet gluten immediately after extraction under carefully standardised conditions to its weight after drying. The ratio is on the average about 3 : 1; that is, gluten carries about twice its weight of water. No generally accepted regularity has been demonstrated, but in gluten from strong flours the ratio is as low as 2·6, whilst in that from very weak flours the ratio is often above 3. As Mr. Hardy points out in the following paper, this ratio is to be associated with the mineral content of the flour.

Emphasis must be laid on the fact that the method of determining gluten by washing is purely empirical and requires careful standardisation before comparative results can be obtained. Measurements of gluten at the best are but a rough-and-ready guide to more exact determinations; they have the advantage that they can be made quickly without special apparatus.

Gliadin Ratio.

Crude gluten consists mainly of two proteins: *gliadin*, soluble in alcohol, and *glutenin*, soluble in very dilute alkalis or acids. It has been suggested that the ratio of gliadin to glutenin, or the ratio of gliadin to the total protein in the flour, influences the quality of gluten and affords a measure of strength. Girard and Fleurent suggested the proper proportion of gliadin to be 75 per cent. of the gluten. Snyder fixed the ideal ratio at 65 per cent., but experience has not supported these views; the gliadin ratio is erratic and apparently of little value for diagnostic purposes. A. D. Hall has adversely criticised the determination of the percentage of gliadin as an indication of strength; F. T. Shutt considers it to be more valuable, and suggests there is an indication of a relationship between the maturity of the grain and the gliadin content. The more fully ripened wheat contains the

higher proportion of gliadin. The subject evidently demands further study.

Proteins of Flour.

As already indicated, wheat contains more than one protein. Gliadin and glutenin make up about 90 per cent. of the total protein matter of the seed; this in addition contains *leucosin*, a so-called albumen, which is freely soluble in water and coagulates when the solution is heated. In gluten the gliadin acts as the sticky binding substance, whilst the glutenin serves to fill up the network of gliadin threads.

These two proteins were thought at one time to have a common origin or to be derived from one another when flour is wetted. Osborne, who has studied the products of their complete hydrolysis, finds that gliadin differs sharply from glutenin in yielding no glycine and no lysine; it also gives nearly twice as much proline as glutenin.

Both gliadin and glutenin, which yield 37 and 23 per cent. of glutamic acid respectively, differ greatly from leucosin, which gives only 6 per cent. of this acid. They both give rise to considerable quantities of ammonia, whereas leucosin yields but little ammonia.

The substances mentioned as decomposition products of gliadin and glutenin all belong to the "amino acids," which modern research has shown to make up the greater portion of the protein molecule.

T. B. Wood has carried out experiments which indicate that gliadin derived either from strong or weak wheats is the same in each case. Osborne's very careful researches all show that the proteins of wheat are of constant composition independent of their origin.

To sum up: whereas, broadly speaking, strength must be associated with the total quantity of gluten or nitrogen in a flour, yet it is the physical properties of gluten, rather than the amount, which determine the behaviour of the flour in breadmaking.

Sugar.

The distention of the loaf is due to the gas formed during panary fermentation from sugar. The amount of sugar actually present in flour would not suffice to give the necessary volume of gas, but it is supplemented by sugar produced from the starch of the flour. The formation of sugar is effected by the agency of a diastatic enzyme; it begins directly the flour is wetted and continues throughout fermentation until the loaf is baked. In general, therefore, the presence of more or less sugar in a flour is unimportant, and the percentage shows no relationship with the volume of the loaf.

Diastatic Enzyme.

Obviously, there must not only be a plentiful supply of gas available to distend the loaf, but also to maintain it fully distended until it is fixed in the open. Flours which have relatively little diastatic enzyme will produce insufficient gas. A deficiency of diastase has been actually proved to occur in many flours tested, or, at all events, better loaves have been obtained in such cases when malt extract or its equivalent has been added to the flour; generally flours contain an excess of diastatic enzyme. Gas escapes from the dough throughout the process of making a loaf; the amount escaping is apparently largest from those flours which contain gluten of lowest quality. The power of the dough to retain gas may be regarded as one of the separate factors involved in the conception of strength.

Wood has made comparative determinations of the amount of gas available for the distention of the dough by incubating flour with yeast and water and measuring the gas evolved, special attention being paid to the last stages of fermentation, since it is this gas which inflates the loaf at the moment it enters the oven. The attempt was made to correlate this factor with strength, but this view has not been adopted, as it is not in agreement with practice. A further objection to these experiments is that they were made under conditions very different from those which prevail in actual bakehouse practice.

Another suggestion has been to correlate strength with the diastatic power of flour. This is impossible, firstly, because normal flours have more than enough diastase to produce the necessary sugar, and secondly, because the diastatic power of flour varies materially on keeping the flour sometimes increasing, at other times falling. The change in the diastatic power affords an explanation of the behaviour of some abnormal flours, the baking strength of which very materially increased on keeping. Further, the diastatic power of flour increases considerably when sodium chloride or other salts are added to the dough.

Starch.

Hardly any attention has so far been paid to the properties of the starch of flour from the point of view of strength. Presumably, however, if the starch in one flour is more resistant to attack by diastase than that in another flour, sugar will not be formed so easily in the former and gas will not be generated so rapidly during fermentation.

Microscopic examination shows flour to consist of starch granules of three different sizes. The smallest granules which preponderate in amount are from 3 to 5 μ in diameter, the largest granules are about 30 to 35 μ, and there are also granules of intermediate

size. The microscopic examination of a large number of flours of different origin has shown that the large granules vary in number from 6 to $1\frac{1}{2}$ per cent. of the total number of granules. In other words, in one flour as much as 30 to 40 per cent. of the total weight of starch is in the form of large grains, whilst in another only 7 to 10 per cent. is in this condition.

Before a starch grain can be converted into sugar the cellular envelope has first to be destroyed. Obviously, when the envelope of the large granule is destroyed a much larger proportion of starch is rendered available than when the contents of a small granule are liberated.

Whymper has recently made a microscopic study of the changes occurring during the germination of wheat. He finds that the larger and more mature granules are the most readily attacked by the enzymes of the plantlet. Though there is no general relation between the size of starch granules of different origin and the ease with which they are attacked by diastase and other agents, it appears that the larger granules of any particular starch are affected sooner than the smaller granules.

The destruction of the cellular envelope of the granule is undoubtedly effected by an enzyme (cytase) about which very little is known. Julian Baker has suggested that poor flours lack a sufficient quantity of cytase, and in confirmation of this view showed that the addition of powdered malt, which contains such an enzyme, improves the size of the loaves obtained from such flours.

Mineral Matter.

The amount of ash in flour seldom amounts to 0·5 per cent., more than one-half consisting of phosphates. There is undoubtedly some relationship between the mineral constituents and the gas-retaining power of gluten, though no complete analyses have as yet been published directly connecting strength with the composition of the ash. Wood, however, states that the soluble ash of Fife flour (milled from a strong English-grown wheat) shows a relatively high proportion of phosphate and magnesia and a low proportion of chloride, sulphate, and lime; whereas the ash of a weak flour contained small proportions of phosphate and magnesia but much more chloride, sulphate, and lime. The influence of small quantities of acids and salts on gluten is dealt with more fully by Mr. Hardy in the following paper.

Fat.

The amount of fat in flour varies from 1 to $1\frac{1}{2}$ per cent., the higher value being a feature of flours from the Canadian North-West. The oil is present to the extent of about 15 per cent. of the wheat germ. It easily turns rancid, and is characterised by a high iodine number (115).

Moisture.

The amount of moisture in commercial sacked flour depends largely on the atmospheric conditions at the time of milling, and therefore on the climate of the country where it was milled.

Enzymes.

The diastase and cytase of flour have already been discussed. The proteoclasts have hardly been investigated. Attention was first drawn to them by Ford, who showed that some flours contain an active proteoclast which is very detrimental to the gas-retaining power of gluten. An erepsin has been identified in flour by Julian Baker. The enzymes in the yeast employed are, however, of the greatest importance to the practical baker.

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IX.

AN ANALYSIS OF THE FACTORS CONTRIBUTING TO STRENGTH IN WHEATEN FLOUR.

By W. B. HARDY, F.R.S.

Reduced to the simplest terms, the physical properties of dough depend upon the protein complex gluten, starch grains, and water. The greater the water-absorbing power of the gluten, that is the greater its water content, the less will be its tenacity and, within limit, the greater its ductility.

Colloid bodies such as moist gluten have a sponge structure, and when solid particles are present the bars of the sponge-work may be seen under the microscope to spring from them. Thus solid particles may enter intimately into the framework, and by their size and number modify the thickness and length of the bars and the size of the interspaces. Rubber loaded with solid particles has elastic properties widely different from those of rubber free from particles, and moist gluten loaded with starch grains differs from gluten washed approximately free from them. It is less like elastic, more like putty, in its mechanical properties—the solid grains of starch act as though they enormously increased the internal friction.

There has, so far as I know, been no exact work upon the influence of the size and number of the starch grains upon the mechanical properties of dough; in the absence of such information it is idle to pursue the point further. This may, however, be said: judging by what is known of the influence of embedded small particles in other cases, the power of the dough to retain its shape may be due in some cases primarily to the nature and number of the starch grains. Whatever the influence of the starch grains may be, they operate as passive agents; the active mechanical properties of dough, its tenacity and ductility, are due to the protein complex gluten. This is the labile elastic cement of the structure.

Now gluten, even though it be prepared from the best Fife flour, *has of itself neither ductility nor tenacity.* In presence of

ordinary distilled water it partly dissolves, the residue—the larger portion—forming a semi-fluid sediment destitute of tenacity. Why? Because tenacity and ductility are properties impressed on gluten by something else—namely, by salts, by electrolytes, that is, which may be organic and may therefore be unrepresented in an ash analysis.

This being the case, it is obvious that any attempt to correlate strength with the physical properties of gluten washed out in the ordinary way must end in failure, since the properties of washed gluten depend upon the electrolytes which happen to be left in after the washing is concluded.

Electrolytes—that is to say, salts, acids, and alkalis—intervene in two absolutely distinct ways. They control the physical properties of the gluten in the dough, and they must also profoundly modify the temperature relations and the rapidity of the change undergone by the gluten and other constituents of the dough in the process of baking—a change which, so far as the proteins are concerned, is, broadly speaking, a lowering of solubility. We know something of the way in which they act on gluten in the dough, but of the more complicated action during temperature changes we know nothing; it is possible that the same electrolyte may increase the mechanical stability of the loaf in the dough and yet diminish it in the oven.

Let us turn to the action of electrolytes upon moist gluten, that is, upon gluten as it exists in dough.

Gluten prepared from wheat by washing the flour in many changes of water is a stringy ductile body capable of retaining bubbles of gas. When it is placed in dilute acid or alkali this property vanishes. As little as 1 part of sulphuric or hydrochloric acid in 20,000, or 1 in 5,000 of acetic or lactic acid, will disperse the gluten in fine particles. There is not only the loss of actual cohesion; the gluten particles are so changed that they actually repel one another, and a non-settling milky suspension is produced. In order to restore cohesion it is merely necessary either to neutralise the acid or to add any salt such as common table-salt.

Any salt confers cohesion upon gluten; any acid or alkali when sufficiently dilute lessens or destroys it. Gluten itself seems to be purely passive.

The removal of salts by washing gluten with distilled water will lower the forces which make for cohesion, so that less and less acid is needed to neutralise them; a point may be reached where apparently any concentration of acid, no matter how low, is sufficient. When gluten is thoroughly extracted with distilled water it loses cohesion and disperses as a cloud, not owing to the action of the water, but because of the faint acidity due to the

carbonic acid dissolved from the air. This can be proved in many ways, most directly perhaps by the fact that careful neutralisation of the carbonic acid will restore cohesion. A brief but more detailed consideration of the action of acids, alkalis, and salts is needed to make these points clear.

Action of Acids and Alkalis.—Acids and alkalis produce the same physical effects, but the latter also induce hydrolytic decomposition of the gluten. The effect of acids is therefore more easily followed, and for simplicity I propose to confine my remarks to them.

Gluten prepared in the ordinary way and immersed in distilled water retains its cohesion unless measures be taken to wash out the salt which it contains. In N/1000 of any strong acid cohesion breaks down, and the change is more rapid as the concentration of acid is *increased* up to about N/30. Further increase in concentration slows the rate of disintegration, until at N/12 for hydrochloric acid, N/25 for sulphuric acid, and 1·75 N for phosphoric acid the gluten again becomes permanently *coherent* and more tenacious and less ductile than in its original state. Weak acids, such as oxalic, acetic, lactic, citric, and tartaric acids, produce disintegration in dilute solution, but fail to maintain cohesion even at very high concentration.

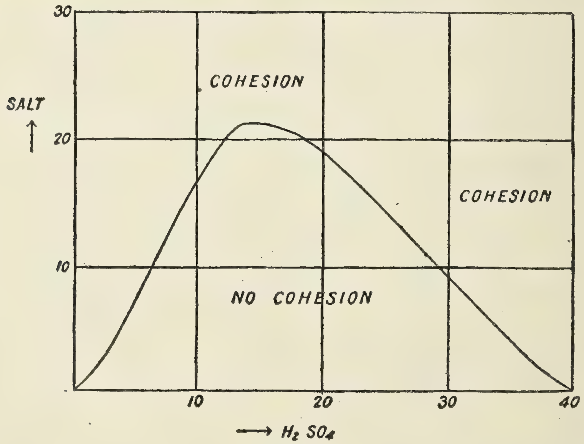

FIG. 1.

When salt is added to gluten which has lost cohesion owing to the action of acid this property is restored, but the concentration of salt needed to undo or prevent the action of the acid varies with the concentration of the acid in a remarkable and characteristic manner. The relations can be best explained by reference to the curve. The ordinates are concentration of sodium chloride, the abscissæ concentration of sulphuric acid, in both cases expressed in grain equivalents per 1,000 litres. The

curve gives the concentration of salt and acid needed just to preserve cohesion. It will be seen that as the concentration of acid is increasing, the concentration of salt needed to maintain cohesion rises to a maximum and thence falls until a point is reached where the acid alone is sufficient. The curve encloses an area of no cohesion, while outside it is a region in which acid and salt maintain cohesion.

Neither of these areas represents uniform states; as is characteristic of colloidal matter, they are areas of continuous changes. The curve which limits them is merely an arbitrary line which marks the place at which cohesion is so far reduced that it no longer suffices to maintain shape against the extraneous force of gravity. Any line, starting within the area of no cohesion and passing through it to the area of cohesion, traverses a system which is continuously changing—namely, a colloidal solution containing exceedingly fine particles of gluten which become continuously coarser until finally, at or near the intersection of the curve, they run together into a coherent mass of gluten. Beyond the curve the line, if it be inclined upwards, follows a system in which still further separation of water and gluten is taking place, the two becoming less and less miscible—the water-holding power of the protein less and less, its tenacity growing, its ductility diminishing.

Electrolytes, therefore, do more than confer on gluten its mechanical properties; they determine also its power of holding water. They also determine the water-holding power of any other colloid matter present in the dough.

Acids and alkalis destroy cohesion and disperse the particles of gluten just as they produce and stabilise non-settling suspensions in many types of colloidal solution—namely, by the development of a difference of electric potential between the particles and the water. The curve which connects the potential difference with the concentration of acid has the same form as the curve given in Fig. 1.

The foregoing analysis of the factors which control the physical properties of gluten in moist dough lead us to a brief analysis of the source of "strength" in flour. It must be borne in mind that loaf-making includes two distinct operations, the making and incubation of the dough and the fixation of the incubated dough by heat. Every factor which contributes to the rising of the dough—that is, to the size of the loaf—and to the power of the dough to preserve its shape (saving only the vital activities of the yeast plants) intervenes also in the fixation of the dough, where it may undo what it has already done. Successful incubation depends upon: (1) The suitability of the dough for the active growth and production of carbonic acid by the yeast plant, which

again depends upon the concentration of sugar, the intrinsic diastatic power of the dough and the concentration and nature of the electrolytes. (2) The physical character of the dough which depends upon the size, shape, and number of starch grains, the nature and concentration of the electrolytes, since these determine the physical properties of colloids present, notably the gluten. The electrolytes will also direct those molecular rearrangements which occur during the baking process and which give fixity and stability to the entire structure.

X.

CHEMICAL WORK ON CANADIAN WHEAT AND FLOUR.

By Frank T. Shutt, M.A., F.I.C., Chemist, Dominion Experimental Farms.

A quarter of a century ago those who were taking cognisance of Canadian development and progress had begun to realise that Canada was destined to become one of the largest wheat-producing countries in the world. The North-West had been, so to speak, discovered, and, at least in parts, its suitability for the production of wheat of the very finest quality established. Since that time the area sown to wheat in the North-Western Provinces has annually increased, of late years at a phenomenal rate. Last season (1908) the western plains yielded in round numbers 106,000,000 bushels from, approximately, 6,000,000 acres; in 1902, only six years ago, the acreage in wheat was less than half that sown last season, with a yield of 67,000,000 bushels. The estimate for the present year (1909) for the three western provinces, Manitoba, Saskatchewan, and Alberta, is 7,000,000 acres in wheat—a million acres a year. And that the possibilities for the further expansion are by no means exhausted will be evident from the fact that as yet but 5 per cent. or thereabouts of the tillable land is under crop.

It was the thought, therefore, that wheat was destined to become, in Canada, a staple crop of the largest magnitude that determined us, almost immediately on the establishment of the experimental farm system, some twenty-two years ago, to devote special attention in the field and laboratory to the solution of problems in connection with this cereal. In this paper it will only be possible to mention some of the more important investigations undertaken by the Chemical Division, presenting very briefly the data obtained and the conclusions reached. More detailed consideration of these various questions will naturally be found in the annual reports and bulletins issued from the Chemical Division of the Experimental Farms, and to which numerous references will necessarily be made.

Red Fife and Imported Wheats.

One of the earlier investigations had for its object the introduction of a wheat equal in quality to the well-known and highly esteemed North-Western Red Fife, which might ripen earlier and thus escape injury to which that variety is occasionally exposed from autumnal frosts. To this end, in 1887, a number of wheats were imported from India, Northern Russia, and other European countries, prominent among which were the varieties Ladoga, Saxonka, Kubanka, and Onega. These, as well as varieties obtained from the North-Western States—Wellman's Fife and Bluestem—were submitted at the outset to chemical and physical examination to determine their relative values as compared with Red Fife, and to ascertain, after growth in various parts of Canada, the effect of environment, soil, climate, &c., upon their composition.*

Among the more prominent deductions made from this work were the following:—

1. That the percentage of protein of the Canadian-grown Russian wheats was very similar in amount to that of Red Fife. The averages were as follows: Ladoga, 14·31 per cent; Saxonka, 13·91 per cent.; Kubanka, 13·77 per cent.; and Red Fife, 14·00 per cent.

2. That the Manitoba-grown Red Fife was fully equal, and indeed somewhat superior in protein, to the best-grown varieties of Minnesota. The samples examined furnished the following averages: Wellman's Fife, 13·68 per cent.; Bluestem, 11·75 per cent.; Red Fife, 14·00 per cent.

3. That growth in the Canadian North-West had, in the majority of instances, markedly increased the gluten content. Thus, imported Ladoga contained 12·75 per cent. protein, while the average of eight samples of grain grown in the North-West from this seed was 14·57 per cent., a significant illustration of the influence of environment on the composition of wheat.

In 1893, when Ladoga had been successfully grown for several years in certain districts of the North-West, a further and more exhaustive study of its flour was made, supplemented by baking trials on a large scale.† We found that, compared with Red Fife, Ladoga yielded a gluten of inferior quality; it was less elastic, more sticky, and yellower. Though occasionally, with special manipulation, a well-risen and fairly white bread was obtained, in the larger number of trials, and when the baking methods were not specially modified, the bread was somewhat flat, heavy, and yellowish. Our experiments indicated further

* Bulletin No. 4. Ladoga, Red Fife, and other varieties of Wheat. March, 1889.

† Bulletin No. 18. Ladoga Wheat. February, 1893.

that, weight for weight, Ladoga flour yielded a larger weight of bread than that of Red Fife.

Composition of Canadian and Foreign Wheats.

As a professional juror at the World's Columbian Exposition, held in Chicago, 1893, the writer co-operated in the analysis of the cereals submitted for award. In this series there were 166 samples of wheat, forty-nine of which were from Canada. The analytical data, which have been published *in extenso*,* furnished evidence of the high nutritive qualities of Canadian cereals in general, demonstrating more particularly the superiority of Red Fife and White Fife wheats as grown in Manitoba and the North-West.

Cross-breds from Red Fife and Ladoga.

Following up this line of investigation, we undertook, in 1899, a comparative study of Red Fife, Preston, Stanley, and Percy wheats as grown in Manitoba, the three latter varieties being cross-breds originated at the Central Experimental Farm from Red Fife and Ladoga.†

The most noticeable feature was the great similarity in composition of the four members of the series. Judged by chemical standards accepted at that time, all were exceptionally good, comparing most favourably as regards protein content with average market samples of the best wheats of the world. Of the cross-breds, Preston only falls behind in protein, while both Percy and Stanley showed slightly higher percentages than Red Fife. The figures were as follows: Red Fife, 12·84 per cent.; Preston, 11·86 per cent.; Stanley, 13·16 per cent.; Percy, 13·67 per cent.

The Grades of Wheat.

The installation in 1904 by the Cerealist of an experimental roller mill and baking oven permitted us from that date on to enlarge the scope of our work with wheats, making it possible to submit to examination the flours from the wheats under inquiry, and to attempt correlation of the chemical and physical data with the results of actual baking trials.

It was thought that some light might be thrown on the question of what constitutes quality in wheat by a closer chemical study of the various commercial grades and the flours that might be obtained from them. The product of the western wheat fields is annually inspected and graded by a Government official, and it was considered of interest to ascertain how far the composition of the wheats, as revealed by chemistry, might agree with the official grading. With these objects in view, samples representing

* *Report of the Chemist*, Central Experimental Farm, 1895. Bulletin No. 45, Division of Chemistry, U.S. Department of Agriculture, Washington, D.C.

† *Report of the Chemist*, Central Experimental Farm, 1900.

the grades from the crops of 1904 and 1907 (Manitoba Inspection Division), with their respective flours, were submitted to analysis.

As might be expected from the fact that at least 90 per cent. of the wheat of these grades is Red Fife, the differences in composition are rather those of degree than of kind. It would appear, therefore, as regards the western wheat, that it is the relative yield of first-class flour (as determined largely by colour) that furnishes the chief basis in the grading rather than any essential differences in the relative strengths of the wheats, though the percentage of piebald or starchy kernels is also taken into account. The "straight" flours from all the higher grades were found to be characterised by a high protein content and an excellent baking value; there seems little doubt but that when examining flours from the same variety the protein content may be taken as a sure index of strength. In flours from normally ripened grain there evidently exists a distinct relationship between protein, gliadin, and dry gluten (as determined mechanically); immaturity—as resulting from the effect of early frosts, &c.—disturbs this relationship, the less fully ripened containing the smaller proportion of gliadin.

These are some of the more important deductions made from the work on these wheats and flours; the detailed results have appeared in bulletin form.*

The Relationship between Composition and Bread-making Value.

During 1906 and 1907 two series of flours from wheats specially selected as representative of spring, winter, and durum varieties (including many cross-breds originated at the Central Experimental Farm) were examined with a view of determining, as far as might be possible, the relationship, if any, between composition and bread-making value, and further, if the contentions of Professor T. B. Wood, of the University of Cambridge, recently put forward regarding the factors that determine strength in flours, would receive support.† In this work, as in former investigations in which flours were examined, we had the co-operation of the Cerealist, who conducted all the milling and baking tests. The conclusions arrived at may be briefly given as follows:—

1. That while, as already noted, the percentages of gliadin and dry gluten increase and decrease with that of the protein, the ratio between these determinations is neither constant nor definite.††

* The Grades of Wheat, 1904, Bulletin No. 50, Expl. Farm Series. The Grades of Wheat, 1907, Bulletin No. 60, Expl. Farm Series.

† *Journal of Agricultural Science*, vol. ii. part i.

†† *Quality in Wheat*, Bulletin No. 57, Exp. Farm Series, pp. 44, 49. *Report of the Chemist*, Exp. Farm, 1908–09, p. 146.

2. That there is a well-marked relationship between the "baking strength" * of a flour and its percentages of protein, gliadin, and dry gluten. The data from both series of flours clearly indicate this relationship, though it was not always possible to establish a definite ratio between the chemical and baking results. †

3. That, while the protein content is undoubtedly the best single measure of strength when judging normally ripened wheats of the same variety, the character of the gluten must be especially taken into consideration when discriminating between wheats of different varieties. In flours of high bread-making values the gluten is resilient, elastic, firm, and cohesive; in poor flours it may be flabby, non-resilient, soft, or sticky.

4. That the view held by many chemists that the gliadin ratio or "number" is of importance as an index of strength received no confirmation from the analysis of Canadian flours. The generally accepted statement that from 55 to 65 per cent. of the protein should exist in the form of gliadin is undoubtedly incorrect; the larger number of the strongest flours examined possessed a gliadin number below fifty. The gliadin number, though holding with the other nitrogenous data in parts of the series, is on the whole erratic, and apparently of very little value for diagnostic purposes. The percentage of gliadin is, according to our evidence, decidedly more valuable. ††

5. That we failed to obtain any evidence confirmatory of the view held by Mr. Wood: that the amount of nitrogen and ash free extract controlled the volume of loaf. If the size of the loaf is determined by the volume of gas evolved in the bread-making process, then this volume is dependent on the enzymic action (which may affect the protein as well as the carbohydrates) rather than on the amount of sugar present in the flour. § We have not observed any relationship between the percentages of sugar, as actually determined, and the volume of loaf.

6. That, while certain of our data seemed to indicate an agreement between the ratio to total nitrogen of soluble salts and shape of loaf—as held by Professor Wood—they did not permit of any direct correlation. §§

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* In determining the "baking strength" of a flour, values have been assigned to water added, water retained, volume, shape and texture of loaf and form of crust (Bulletin No. 57, Exp. Farm Series, p. 18).

† Bulletin No. 57, pp. 41, 45, 50. *Report of the Chemist*, Exp. Farm Series, 1908-09, p. 146.

†† Quality in Wheat, Bulletin 57, pp. 41, 42. *Report of the Chemist*, Exp. Farm, 1908-09, p. 146.

§ Quality in Wheat, Bulletin 57, pp. 43, 47, 48.

§§ The Grades of Wheat, Bulletin 60, p. 19. *Report of the Chemist*, Exp. Farms, 1908-09, p. 147.

The Effect of Dampness on the Quality of Wheat.

It sometimes happens in the wheat fields of North-Western Canada that, owing to inclement weather following the cutting of the grain, wheat becomes damp while in the stook, and may remain so for some weeks before it is threshed. As such wheat is accounted of a lower commercial grade by reason of the duller and paler appearance of the grain, because also of the common impression that the moisture in the grain has injuriously affected the gluten and thus impaired the resultant flour for bread-making purposes, it became a question of considerable importance to ascertain, by chemical and baking tests, how far this contention might be correct. Wheat that has been damp through exposure and subsequently dried is known commercially as "tough." Three samples of such wheat from the crop of 1907, which had been dried at the elevator, were submitted to analysis. All were found practically normal as regards moisture, and gave glutens of excellent quality. We concluded from a general survey of the analytical results that these wheats, from which about 5 per cent. moisture had been driven off at the elevators, had not appreciably suffered in quality.*

Further prosecution of this inquiry was made possible through the co-operation of Dr. Charles E. Saunders, the Cerealist, who had instituted a series of experiments to learn what deterioration might take place in break-making value when wheat was kept more or less damp for a longer or shorter period before being milled. The wheat under experiment remained moist at temperatures ranging from 40° F. to 58° F. for a period of twenty-seven days, samples being taken for analysis at various intervals (five minutes, ten, twenty, and twenty-seven days), spread in thin layers to dry and then milled. In the sample that had been kept twenty days mustiness was noticed, and in that which had been damp for twenty-seven days the mustiness was more pronounced, and sprouting had commenced. The analysis of the resulting flours was of the most comprehensive character. A detailed study of the results indicates that wheat may contain an excessive amount of moisture for some considerable time without its composition being very materially affected. It was evident, however, that there had been a slight falling off in the percentage of dry gluten and a deterioration in quality in those wheats in which the mustiness was marked and sprouting had begun.†

Influence of Storage on Wheat and Flour.

It is generally conceded that flour improves as to colour and strength with age. To discover such changes in composition as

* *Report of the Chemist*, Exp. Farms, 1908–09, pp. 148, 149.
† *Report of the Chemist*, Exp. Farm, 1908–09, pp. 145, 146.

might explain this improvement, a considerable amount of chemical work has been done on a series of wheats and flours stored under ordinary conditions by the Cerealist for the purpose of determining the influence of age on bread-making value. The storage period was sixteen months, three of the series being kept both as grain and flour, and four as grain only.

The Cerealist found that "when the material is kept over in the form of flour there is a more rapid improvement in colour and in strength than when it is kept as wheat. In every instance there was a gain in water-absorbing power, and, as a rule, this gain was considerable. There was also invariably an improvement in the shape of the loaf." The chemical data indicated a slight increase in the protein content, this increase being more marked in samples which had been kept over as flour. The probable explanation of these phenomena is that the carbo-hydrates are being continually oxidised, the rate of oxidation being determined by the area of surface exposed.

A slight improvement in the physical characters of the gluten from the stored wheats and flours was remarked, the improvement being more noticeable in the weaker members of the series.

A tendency towards an increase in gliadin was observed, showing a certain amount of parallelism between protein content and gliadin.*

The Influence of Environment on the Composition of Wheat.

While it has been held that the composition of the crop is determined largely by that of the parent seed—in other words, that heredity is a potent, possibly in some cases the dominant, factor in influencing the character of the seed, it seems nevertheless true also that environment has a most marked effect on the grain. The term environment here is naturally used in its widest sense, and would include the influences exerted by climatic conditions, nature, and culture of soil, &c.

It has been a matter of common observation that wheat grown on newly cleared scrub-land in certain districts of the North-West is more or less "soft" or starchy in character. The seed sown may be No. 1 Hard or No. 1 Northern—hard, semi-translucent, and glutinous—and the product on such soils will, as a rule, contain a proportion of kernels with whitish, opaque spots—piebald wheat—indicating clearly a deterioration in quality from a commercial point of view. With cultivation of the soil this tendency to produce soft, starchy wheat apparently disappears, the character of the wheat generally improving, so that after a number of years the quality of the wheat grown may be greatly superior, as measured by protein content, to that which is at

* *Report of Chemist*, Exp. Farms, 1908–09, pp. 149, 150.

first produced. Though the change is usually gradual and in the same direction, it has been noticed that the quality of the wheat on such land is markedly influenced by the character of the season, so that while in some years there may be but little difference between the crops from the older and the newer land (seed of the same description being sown on both), in other years the difference may be so great that their common parentage is not at all apparent.

This change from a hard, semi-translucent kernel to one that is soft or piebald is a change, as already indicated, not only in external and physical characters, but in chemical composition; it is a falling off in commercial value marked by a decrease in the protein (gluten) content. Its extent can therefore be accurately traced by chemical means.

The Dauphin district (North-Eastern Manitoba) is one of those in which there is a considerable area of this scrub-land—*i.e.*, land covered with small trees, shrubs, &c., and generally characterised by a high percentage of vegetable matter. As a rule, the district is favoured with an abundance of rainfall. Its wheat has been very largely piebald in character, though settlers claim it is improving in quality with the working of the soil. In 1905 we obtained from Valley River, in this district, three samples of wheat and submitted them to analysis:—

A.	Wheat used as seed	11·11	per cent.	protein.
B.	Wheat grown as first crop after "breaking"...	9·93	"	"
C.	Wheat grown on soil cultivated 9 years ...	12·62	"	"

First, we have in these results an illustration of the extent to which environment may affect the composition of wheat in one season. Secondly, it is to be noticed that the wheat from the newly cleared land (B) is decidedly less glutinous (softer, starchier) than the grain from the older soil (C). The wheats differed considerably in appearance. The seed wheat was a fairly good sample, grading No. 1 Northern; the product from this on the new land was decidedly soft, with many opaque starchy kernels; that from the older soil was somewhat superior to the parent seed.

To ascertain, if possible, the factors that determined this modification, the softer grain (B) was sown the following season on areas of newly cleared and old land on the same farm. In addition to the analysis of the wheats harvested, soil-moisture determinations were made from time to time throughout the growing season, and samples representative of the soil of the areas under experiment chemically examined:—

	Wheat used as seed (B)...	9·93	per cent.	protein.
D.	Wheat grown as first crop after "breaking"...	10·01	"	"
E.	Wheat grown on soil cultivated 10 years ..	13·52	"	"

E 2

Wheats (B) and (D) would be termed piebald or soft, and are very similar in appearance. Wheat (E) shows no starchy grains, the kernels being hard and translucent, typical of the highest grades. The difference in protein content between (B) and (D) is insignificant, but between these wheats and (E) it is very great—3·5 per cent.

The moisture content of the soils of the two areas was found to be as follows :—

	May 5.	May 15.	May 29.	June 22.	July 13.	Aug. 2.	Aug. 24.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Newly cleared land ...	32·96	36·49	33·45	30·49	35·23	30·37	32·84
Cultivated land	22·45	23·39	23·39	21·70	21·24	13·24	18·28

These data are highly significant. The newly cleared soil which produced the softer wheat was throughout the growing season more moist; its percentages of water ranged from 9 to 14 higher than those of the soil giving the harder grain. And it is to be noted that there was no drying out in the newly cleared soil as the season advanced.

The soils on analysis were found to have the following compositions :—

	Newly cleared Soil.	Soil 10 years under Cultivation.
	Per cent.	Per cent.
Moisture	2·98	2·06
Organic and volatile matter	20·90	12·84
Insoluble residue (sand, clay, &c.) ...	51·74	65·07
Oxide of iron and alumina	5·50	10·52
Lime	10·25	3·47
Magnesia	2·44	1·63
Potash	0·14	0·19
Phosphoric acid	0·15	0·13
Soluble silica	0·02	0·02
Carbonic acid, &c. (undetermined) ...	5·88	4·07
	100·00	100·00
Nitrogen in organic matter	0·642	0·371
Available constituents :—		
Phosphoric acid	0·0067	0·0067
Potash	0·0166	0·0069
Lime	1·306	0·93

The characteristic feature of these soils is their richness in vegetable matter and nitrogen; it will be noticed that the percentages of these constituents are very considerably higher in the newly cleared soil. This larger proportion of humus is probably the true explanation of the higher moisture content of the

newly cleared soil, since humus enhances the absorptive and retentive capacity of a soil.

In potash and phosphoric acid these soils present no striking differences, though the newer soil is much the richer in lime. The data, apart from the relation of humus to moisture content, throw no light upon our problem.* It is interesting, however, to observe that the soil with the higher percentage of nitrogen produced the starchier wheat. From these results we were led to believe that the explanation for the difference in composition of the wheats is to be found in the widely different moisture content of the soils throughout the growing season, the larger amount of moisture prolonging the vegetative processes of the plant and delaying the maturation of its grain. This apparently allows the further deposition of starch, or rather of less nitrogenous matter, resulting in a more or less soft kernel.†

If these conclusions are correct, then it might be conjectured that wheat grown under irrigation in a semi-arid district would be more or less glutinous according to the amount of water supplied during the development period. To obtain information concerning this matter, areas irrigated and non-irrigated were sown in 1908 on the Experimental Farm, Lethbridge, Southern Alberta, with Red Fife and Kharkov wheats. This district is usually one of sparse precipitation, and one, consequently, where the methods of the so-called "dry" farming must be practised in parts where there is no provision for irrigation. As a rule, irrigation is necessary to obtain the best yields. The season during the earlier months was unusually wet, and consequently not favourable to the experiment in hand, only one irrigation, July 16th, being found necessary; nevertheless, as the following data clearly show, the irrigated soil, with its higher water content, produced the more starchy wheat.

Red Fife—original seed from Brandon, Man. ...	15·95	per cent.	protein.
Red Fife—grown on irrigated land	13·70	„	„
Red Fife—grown on non-irrigated land	16·37	„	„
Kharkov—grown on irrigated land	12·11	„	„
Kharkov—grown on non-irrigated land	13·12	„	„

In the case of Red Fife, the wheat grown on the non-irrigated and, as we shall see, drier soil contained 2·5 per cent. more protein than that from the irrigated area. Similarly with the Kharkov, there is a difference of 1 per cent. protein in favour of the non-irrigated wheat.

The soil-moisture determinations made at intervals throughout the season are as follows:—

* The analysis of the wheats from the fertiliser plots of the Experimental Farms confirms the view that manuring has but little influence on the composition of the grain.

† *Report of the Chemist*, Exp. Farms, 1907–08, pp. 135–9.

	Irrigated.	Non-irrigated.
	Per cent.	Per cent.
May 14, 1908	16·56	15·61
July 15, 1908	8·78	8·11
August 17, 1908	10·37	6·38

From the beginning of the season until the middle of July, during which time there had been no irrigation, the soils on both plots were very similar in water content, the figures showing a steady decline. Subsequent to that date the percentage of water continued to fall off in the non-irrigated plot, while in the adjacent irrigated area, as might be expected, it increased.

In these results we again have satisfactory evidence that the composition of wheat is markedly influenced by the amount of soil moisture present during the development of the kernel.

To sum up, climatic conditions influence the quality of the wheat through the vegetative processes by shortening or lengthening the time which elapses between the formation of the kernel and its maturity—the shorter the period, the higher the protein content within certain limits. High temperatures, long days, and absence of excessive moisture during the later weeks of development, we have evidence, hasten the maturation of the grain and increase its percentage of gluten. These are the conditions that prevail in the North-Western wheat areas in those seasons which give the largest proportion of first-quality wheat, and we may therefore argue that in them we have an asset fully equal in importance towards the production of the finest grain to that which we possess in our fertile prairie soils.

XI.

A COMPARISON OF THE BAKING QUALITIES OF THE FLOUR FROM SOME OF THE GRADES OF WHEAT PRODUCED IN THE WESTERN PROVINCES OF CANADA.

By Professor R. HARCOURT.

The object of the investigation was to learn something about the relative bread-making value of leading grades of wheat now produced in Canada. The work included a study of three grades of spring wheat, *i.e.*, Nos. I., II., and III. Northern, and of the most important grades of winter wheat grown in Alberta—Nos. I., II., and III. Alberta Red and Nos. I., II., and III. White winter wheat. The spring wheat is the most important, as it forms a very large proportion of the wheat exported, whilst only a comparatively small amount of the Alberta Red and very little

of the Alberta White has been exported. The chief variety among the spring wheats is the well-known Red Fife. The Alberta Red is in reality the Turkey Red, originally of Russia, brought into Alberta from the State of Kansas, where it is known as Kansas wheat or Kansas Red; Dawson's Golden Chaff forms the greater part of the Alberta White winter wheat.

The following table gives data which in a general way indicate the quality of the wheat:—

TABLE I.—*Comparative Weights of Wheat, Percentage Yield of Flour and Protein Content of Wheat.*

Grade of Wheat.	Weight of 100 Kernels. Grams.	Weight per measured Bushel.	Per cent. of Protein.	Per cent. of Flour.*
SPRING WHEAT.				
Winnipeg sample:				
No. I. Northern	2·89	62·5	11·66	57·6
No. II. "	3·02	62·25	11·33	55·8
No. III. "	3·10	61·0	11·36	50·0
Cargo lots:				
No. I. Northern	2·70	63·5	11·48	55·0
No. II. "	2·65	62·5	11·52	49·5
No. III. "	2·52	61·25	12·23	48·8
WINTER WHEAT.				
Alberta Red:				
No. I. Northern	3·68	64·5	10·71	58·8
No. II. "	3·50	64·0	10·69	53·5
No. III. "	3·65	63·25	10·93	50·2
Alberta White:				
No. I.	4·01	62·5	10·47	55·4
No. II.	3·97	61·2	10·77	54·9
No. III.	3·65	61·2	10·37	52·2

* The mill used was made by the Allis-Chalmers Company, Milwaukee. It has a pair of six inch corrugated rolls and a pair of smooth rolls of the same size. The flour is bolted through ordinary sized bolting cloth, but there are no aspirators. The machine is too small to secure absolutely accurate results. The wheats were milled as closely as possible without destroying the colour of the flour too much and the esults should be comparative, although they do not represent exhaustive milling.

It is a well-recognised fact that the conditions included in the term environment cause very marked differences in the quality of the same variety of wheat. Thus climate—including under this term the variations due to season and the condition of the soil—has a very marked influence on the quality of the wheat produced; consequently the milling qualities of the wheat and the baking properties of the flour produced from it are bound to vary from year to year. No attempt has been made in the work herein

reported to study the influence of environment, the object having been to compare the quality of the various grades of wheat as they appear on the market. It is true that a miller may purchase wheat of a certain grade in one district that may be superior to that grown in another; but the great bulk of the wheat passes through the large elevators, in which wheat from many districts, grown under a great variety of conditions, is mixed together, so that the characteristics peculiar to localities are lost in the general mixture.

One set of samples, Nos. I., II., and III. Northern, were received direct from Mr. David Horn, Chief Grain Inspector; they were taken from his mixed samples, but probably these were not gathered from an area wide enough to exclude all the influences of environment. Another set of Nos. I., II., and III. Northern was secured from the elevator at Goderich, Ontario; the samples represent these grades as they actually reach the miller in the older provinces or in Great Britain. The samples of Alberta Red and Alberta White were sent from the Grain Inspector's office at Calgary, Alberta.

As indicated by the weight of 100 kernels, there is not much difference in the size of the kernels of the No. I. Northern received from Mr. Horn and that of the cargo lots; but there is considerable difference in the Nos. II. and III. grades. The No. III. of the cargo lots is a smaller grain and contains more shrunken grain, which probably accounts for the higher percentage of protein.

As the only method at present available of determining the relative value of a flour for bread purposes is by actual baking trials, the flours made from the wheats under discussion were baked in our own flour-testing laboratory, which is fully equipped with electric-proof and baking ovens so arranged that we have almost absolute control of the temperature, accurate balances for weighing flour and bread, apparatus for determining the volume of loaf as bread, expansion of glutens, &c. The work was done by a thoroughly competent person, who is constantly at the work and has developed that delicacy of feel which can only be acquired by constant practice.

In the baking trials 340 grams of flour and sufficient water, salt, sugar, and yeast were used in making each loaf of bread. The yeast is used in what might be considered excessive quantities. The object is to cause the dough to rise as high as possible and thus bring out the strength or at least the expansive power of the flour.

The following table gives the weight of a loaf of bread from each of the different samples of wheat. The yield of bread was determined as accurately as possible; while it perhaps does not represent the yield that would be obtained in a large baking, the

figures are comparative. The volume of the loaf was carefully determined by displacement of fine seed and is given in cubic centimeters. The comparative colour and texture of the bread and general appearance of the loaf are represented by figures; the No. I. samples of the different kinds of wheat being assigned the full 100 points, and the others were scored in percentage of this.

TABLE II.—*Weight, Size, and Quantity of a Loaf of Bread from 340 grams of each kind of Flour.*

Grade of Wheat.	Per cent. of Protein.	Per cent. of Wet Gluten.	Per cent., Water Absorbed.	Weight of Loaf. Grams.	Volume of Loaf. c.c.	Quantity of Bread.		
						Colour.	Texture.	Appearance.
SPRING WHEAT.								
Winnipeg sample:								
No. I. Northern	9·98	33·10	67·2	511	2,540	100·0	100·0	100·0
No. II. "	10·02	31·20	67·5	503	2,520	102·0	98·0	98·0
No. III. "	10·08	30·17	68·0	496	2,770	102·0	96·0	96·0
Cargo lots:								
No. I. Northern	10·97	33·83	67·2	510	2,630	100·0	101·0	101·0
No. II. "	10·32	32·87	67·5	504	2,600	100·0	102·0	100·0
No. III. "	10·88	33·79	67·5	510	2,540	100·0	100·0	99·0
WINTER WHEAT.								
Alberta Red:								
No. I.	9·69	37·53	55·6	491	1,990	100·0	100·0	100·0
No. II.	9·54	32·83	55·6	481	1,900	95·0	96·0	100·0
No III.	9·20	32·07	56·9	492	1,880	93·0	94·0	98·0
Alberta White:								
No. I.	8·31	27·97	50·3	472	1,480	100·0	100·0	100·0
No II.	8·74	29·07	51·6	471	1,470	95·0	85·0	—
No. III.	8·88	27·90	51·6	482	1,600	97·0	104·0	108·0

As might be expected, the results show a great similarity in the quality of the bread obtained from the two lots of spring wheats. The samples representative of cargo lots are more uniform in quality than those obtained from the Chief Grain Inspector; this is doubtless due to the more thorough mixing of wheat produced from different localities and grown under varying conditions, thus obliterating the influences of environment.

The flour from the Alberta Red wheats contained as much gluten as the spring wheat flour, No. I. sample even exceeding all others; but they are much lower in water absorption, yield of bread, and size of loaf. The volume of the loaf was approximately only 75 per cent. of that of the spring wheats. In our work with flour we have always found that, generally speaking, the small loaf was a heavy one, doubtless due to the lesser surface for evaporation

of water. No attempt was made to compare the quality of the bread with that from the spring wheat, as they are quite different; the texture particularly was not so good, the bread was darker, and the loaf had not that bold, fine appearance characteristic of the bread from the spring wheats. In general, it was more like that obtained from the *Durum* wheats.

The Alberta White wheat flour seemed to be very similar to that made from the same variety—*i.e.*, the Dawson's Golden Chaff, grown in Ontario; but it is not equal to the flour from the amber wheats or many other varieties produced in the older provinces. No explanation of the fact that the third grade of Alberta White wheat produced the largest and best loaf of bread is necessary, as these are not mixed samples.

In many cases spring wheats are ground and baked separately; but very frequently such grain is blended with the locally grown softer wheats of the country into which it is imported. These softer wheats have not sufficient gluten to produce a large well-raised loaf of bread, and the texture is usually comparatively poor. On the other hand, the strong spring wheats yield a large, well-piled loaf of good texture, but the bread is inferior in flavour. The blending of the two wheats imparts to the bread made from it some of the desired properties of both, and the result is the production of a loaf of bread which, although not so large as that made from the spring wheat flour, is of good texture and flavour. To illustrate this point a series of blends were made with various proportions of the Manitoba spring wheat flour with that made from Ontario winter wheat. The bread from the Manitoba spring wheat flour was taken as the standard for colour, texture, and appearance. No marks were given for flavour, as it was difficult to make an accurate judgment on this point. The results of the baking trials are given in the following table:—

TABLE III.—*Yield of Bread, Volume of Loaf, and Quality of Bread from the Blended Flour.*

Kind of Flour.			Per cent. Water Absorbed.	Weight of Bread. Grams.	Size of Loaf. c.c.	Quality of Bread.		
						Colour.	Texture.	Appearance.
Manitoba. Per cent.		Ontario. Per cent.				Per cent.	Per cent.	Per cent.
100		—	66·4	523	2,740	100·0	100·0	100·0
60	+	40	63·5	507	2,670	99·0	99·0	98·5
50	+	50	61·8	495	2,400	98·0	98·5	96·0
40	+	60	59·4	496	2,390	97·0	98·0	95·0
30	+	70	58·2	489	2,060	96·0	96·0	92·0
20	+	80	56·7	490	1,900	95·0	95·0	90·0
—		100	48·0	477	1,830	94·0	94·0	87·0

The yield of bread, volume of loaf, and quality of the bread decreased with the increase of the proportion of the soft flour; if size of loaf is not an important point, it is evident that 50 or 60 per cent. of the soft flour can be introduced without seriously affecting the general result.

The Alberta Red wheat is used almost entirely for blending purposes. Even in Alberta it is not milled alone. As previously noted, the No. I. sample contains a very high percentage of gluten, much higher in proportion to the protein content than the spring wheat. But these results are reported after being repeatedly duplicated by an experienced person; while the percentage amount is undoubtedly high, they are as correct as can be got by the usual method of washing glutens.

To gather some data on the value of these wheats for blending purposes we have mixed varying proportions of the Alberta flour with Ontario winter wheat flour, and carried it through the regular baking trials. In every case the bread obtained was much superior to that got from either flour alone. The results were very interesting; but although we have made several blends, they were all made with the wheat of one crop and with only one sample of soft flour, and we do not feel that we have sufficient data to warrant the publication of the results.

XII.

THE HISTORY OF THE WHEATS.

By Dr. OTTO STAPF.

When it was suggested to me that I should prepare a paper on the history of wheat, I hesitated, as I was aware that within the last twelve months or so this old and much-discussed question had assumed a new aspect in consequence of Dr. Aaronsohn's remarkable discoveries, which were claimed to have solved the problem of the origin of wheat. Having had no opportunity of testing the validity of those claims, I was reduced to the necessity of keeping my paper within the limits of a review of the present conditions of the problem, with such observations and suggestions as I might have to offer from my own investigations. There were the latest researches respecting the earliest civilisations, particularly in so far as the Indo-germanic peoples are concerned—researches connected with the names of Hahn, Hirth, Gradmann, Götz, and Otto Schrader. They had thrown much light on the first stages of agriculture, and incidentally the earliest history of the cereals, among which the wheats have always stood in the front rank. There were Buschmann's valuable contributions to our knowledge of prehistoric cultivations and the delightful essays on "Wheat and Tulips," by Count Solms-Laubach, who by in-

genuous reasoning sought to transfer the origin of wheat to Central Asia and to a geological period more remote than had been previously suggested. There were also Schweinfurth's numerous articles on the economic botany of Egypt, ancient and modern, contributions of fundamental value, but scattered through many and often almost inaccessible journals, and therefore not always turned to full account. Much of that literature, I reasoned, must have escaped the professional botanist and agriculturist, and it was time that it should be brought to their notice. It might arouse their interest and, beyond their circles, the interest of all who are accustomed to trace the present in the past, seeing in it merely the latest link in a long chain through which runs the never broken stream of life. It might fall on fertile soil and stimulate further and better organised research in a field which is full of abiding interest and practical promise, but also demands great versatility from the student and the co-operation of various departments of learning. But if I had still any doubts as to the appropriateness of dealing with this subject, they were set at rest when almost at the last moment, thanks to the generosity of Professor Schweinfurth and Professor Max Koernicke, material came into my hands which went a long way to confirm Aaronsohn's discovery of the primitive or wild state of wheat.

I have used in the title of this paper the expression "the wheats" instead of simply speaking of "wheat." This requires a few words of explanation. What we usually understand when we speak of "Wheat" comprises a multitude of races, mostly of economic interest, which fall under one of the three groups of the Soft, the Hard, and the so-called English wheats; or, to use their Latin designations, the *Vulgare*, the *Durum*, and the *Turgidum* Wheats. To them might be added as less common and economically less important wheats, those of the *Compactum* and *Polonicum* group, popularly known as "Dwarf" and "Polish" wheats. With the exception of the last, all these together form, in the system devised by the prominent agrostologist, Eduard Hackel, the sub-species *tenax* of the species *Triticum sativum*. They are characterised, as the name *tenax* indicates, by having spikes with a tough spindle which, when mature, does not break up into joints and grains easily falling out from their husks or glumes. To these wheats proper are opposed the so-called Spelt wheats. The spindles of these break up into joints at maturity, the grains falling with their husks and being more or less difficult to separate from them. To this group we have to refer, of cultivated wheats —the Spelt proper (*Triticum Spelta*), the Emmer (*Triticum dicoccum*), and the One-grained wheat or Einkorn (*Triticum monococcum*); further, the two wild wheats, *Triticum ægilopioides* and *Triticum dicoccoides*. The macroscopic characters mentioned are,

however, correlated with anatomical differences in the structure of the shell or pericarp of the grain, which still more accentuate the separation of the wheats proper and the Spelt wheats. From this standpoint the Polish wheat, which generally is treated as a distinct species, has to go with the wheats proper. Those are the principal kinds as they present themselves to the practical man without consideration of their taxonomic value. At present they are rather definite and distinguishable units, whatever their place and relative position in the evolution of the wheats may be. It need only be added that the various Spelt wheats differ more from each other than do the wheats proper. Those ten wheats, however, are not only fairly well definable, but they are also constant in the sense that we cannot turn Soft wheat into Hard wheat, or Spelt into Emmer; nor has it been proved so far that the two wild wheats can be transformed into their assumed cultivated representatives, as we can, for instance, convert the wild carrot into the garden carrot. But too much stress must not be laid upon that, as *Triticum œgilopioides,* the assumed primitive form of the Einkorn, has not been much experimented with, whilst *Triticum dicoccoides,* the supposed Emmer, was only rediscovered quite recently—having been known before solely from a single herbarium specimen—and is approaching now only its second harvest in the experimental grounds at Poppelsdorf, Bonn. In valuing the affinities of those wheats and tracing their descent, we have therefore to rely on the varying degrees of their structural resemblances, the nature of the differentiating characters, the presence or absence of intermediate forms, other than hybrids, and on analogies. We have seen that the wheats are divided into two groups by what is no doubt a practical difference of the highest order; the looseness or tightness of the grain in the husks, combined with the toughness or brittleness of the spindle, on the one hand, and the thicker or thinner grain shell, on the other. These are three characters, each by itself, as characters in grasses go, apparently of considerable taxonomic value; but if we consider their part in the economy of those plants and the constancy with which they occur side by side, it becomes clear that they are really very closely correlated and behave functionally like one character. Among the wild grasses effective dissemination is provided for by a great variety of contrivances and generally regulated so that the grains are dispersed singly or nearly so, and at the same time protected by some covering until germination sets in. In the two wild wheats this is secured by the breaking up of the spindles on maturity, releasing thereby the individual one- or two-grained spikelets and by the permanent enclosure of the grains in the husks. We find the same conditions in the grasses which are generally admitted as the primitive forms of rye and barley. In cul-

tivated rye and barley the spindles are tough, and in rye and certain kinds of barley, the naked barleys, the grains are loose in the husks and separate easily, while in the other barleys the grains together with their special husks (flowering glume and pale) are loose in the spikelets. But although they are loose they are not loose enough to fall out very readily or without the application of mechanical pressure, such as is applied in threshing. This enormously facilitates reaping, and, where the grains are loose, their subsequent separation from the husks; it determines to a great extent the economic value of these cereals, while the same conditions would naturally be disadvantageous or even fatal to plants in their natural states. And what is true of the cultivated and the wild ryes and barleys is *mutatis mutandis* true of cultivated and wild rice and of the cultivated and wild millets. If we now apply the same reasoning to the wheats of the *tenax* group—that is, the wheats with tough spindles—this character, with its correlations, loses practically all its value as a guide for taxonomic purposes, and we are thrown back, after eliminating it, on what is left of structural differences or resemblances. It is true a great deal has been said about the sexual affinities of the wheats, and the long series of experiments by the Vilmorins, Beyerinck, Rimpau, and others have thrown a flood of light on the facilities of the wheats for hybridisation. Much has been made especially of the difficulty of crossing Einkorn with other wheats, and its position as a distinct species has on that account been universally admitted. But common wheats have been successfully crossed with, structurally, much more remote species of *Ægilops* and even with rye. Moreover, so-called generic hybrids are becoming more and more frequently known, while, on the other hand, many species structurally very similar resist all attempts at crossing. Therefore the argument from sexual affinity to genetic affinity loses very much of its force; in fact, the latter and its degrees will always have to be inferred in the first place from structural resemblances, the term "structural" including external as well as anatomical characters. I will now set out briefly the genetic relations of the wheats as they appear to me viewed from that basis, and I will start from the two wild wheats, *Triticum œgilopioides* and *Triticum dicoccoides*.

Triticum œgilopioides (Balansa) is a species ranging from the Balkan Peninsula and the Crimea to Syria and Upper Mesopotamia. Koernicke distinguishes two races, a weaker one from the Balkan Peninsula and a more robust one from the Asiatic part of the area. The structural resemblance of this species and the Einkorn, *Triticum monococcum*, is so complete that it is quite evident and generally admitted that the Einkorn has originated from *Triticum œgilopioides*. It has given rise to few races, and such as there are point rather to the Asiatic variety than to the

European as the primitive form. The only obvious change it has undergone in the process of domestication is in the great reduction or almost complete suppression of the hairs of the spindle, which in the wild form are long, white, and altogether conspicuous. I may at once remark that the same applies more or less to most of the domesticated wheats, and it may be that this character also enters in the correlation-plexus, which is connected with the dissemination of the wild wheats, and which I mentioned before. Einkorn is, no doubt, one of the oldest wheats. Schliemann found its grains in considerable quantity in the ruins of Troy, in the so-called second town, which is approximately dated at 2000 B.C.; it has also been found in neolithic strata in Hungary and Switzerland. The ancient Greeks knew it as Τίφη and Ἁπλῆ Ζεά; but the Romans do not seem to have cultivated it, except in Upper Italy, and if the Spaniards received it early, as seems to be the case, it must have been by way of Gaul. It is still a common cereal with them; otherwise it is grown in France, Switzerland, Wurtemberg, Thuringia, and in some parts of the Balkan Peninsula. It does not seem to have spread eastward from its original home.

The only other wild wheat is *Triticum dicoccoides*. So much turns on the discovery of this species that a short account of it is necessary. In 1855 Theodor Kotschy collected a specimen of *Triticum* on Mount Hermon, in Syria. It evidently did not strike him as remarkable, as he does not mention it in his description of the flora of that mountain; nor was it noticed by any other botanist until in 1889 the late Professor Koernicke announced at a meeting of the Niederrheinische Gesellschaft at Bonn that he had found the primitive or wild state of his *Triticum vulgare* (which includes all the wheats with the exception of the Einkorn) in Kotschy's plant from Mount Hermon. This he named *Triticum vulgare* var. *dicoccoides*. Nothing beyond a bare note stating this announcement was published at the time. But when, a few years ago, Professors Ascherson, Schweinfurth, and Warburg made arrangements with a young Palestine farmer and botanist, Mr. Aaronsohn, for the agricultural exploration of his country, they also called his attention to Kotschy's *Triticum*. In June, 1906, we find Aaronsohn travelling from Lake Tiberias to Mount Hermon in search of the wheat. On the 12th of that month he discovered the first colony of it a few miles to the north-west of the site of ancient Capernaum, on Lake Tiberias. It was growing in scattered tufts, associated with *Echinops, Ononis, Prosopis,* &c., and nearly always with *Hordeum spontaneum,* the wild barley. Crossing the Jordan and travelling towards Mount Hermon, he again came across it near Arny, on the southern end of the mountain, and then in many localities on the eastern slopes of

Mount Hermon, in places ascending to over 2,000 m.; also on the northern slopes above Rascheia, where Kotschy found it fifty years previously, and from there eastwards to where the plateau extending towards Damascus begins. Here on Mount Hermon it was frequently associated with *Triticum ægilopioides,* and near Rahle both species formed complete fields, with *Triticum dicoccoides* as the predominant partner. Last year Aaronsohn discovered *Triticum dicoccoides* in the country of Gilead, east of Jericho, growing under conditions similar to those in the Hermon district. One feature of Aaronsohn's specimens is their want of homogeneity. This was already observed by the late Professor Koernicke, who, in a letter to Professor Schweinfurth written shortly before his death, said that the diversity of forms in Aaronsohn's material of *Triticum dicoccoides* was quite bewildering. This will have to be taken into account in estimating the bearing of Aaronsohn's specimens on the question of the origin of wheat, particularly when the results of the Poppelsdorf experimental series come to be worked out. Aaronsohn not only observed *Triticum dicoccoides* growing in intimate association with *Triticum ægilopioides,* but it seems (in one locality) also in the neighbourhood of wheat fields. The latter is not quite clear, but it is of the greatest importance to be certain about it, as the introduction of hybrids of *Triticum dicoccoides* and *Triticum durum* into the Poppelsdorf experiments might considerably affect their validity.

On comparing the specimens of *Triticum dicoccoides,* which I have seen myself, with our cultivated wheats, I was at once struck by the great resemblance of a glabrous form to a Hard wheat in the Kew collections from Urumiah in Persian Kurdistan. There was, no doubt, the differential correlation-plexus which separates the wheats proper from the Spelt wheats, and there was also the roundish cross-section of the grains of the Urumiah wheat against the triangular one of the grains of *Triticum dicoccoides,* a character very likely correlated with the respective looseness and tightness of the grains in the husks. But apart from that and the somewhat longer and considerably rougher awns in the *dicoccoides* specimen, the resemblance, not so much of the whole spike but of some of the detached spikelets, amounted almost to identity. Even the villosity of the spindle edges was only slightly less pronounced in the Urumiah wheat than in the wild state. Unless we have here, in the glabrous *dicoccoides* specimen, a cross of *Triticum dicoccoides* with *Triticum durum* (in which case, however, neither the fragility of the spindle nor the tightness of the grain in the husks nor the shape and anatomical structure were affected), the conclusion seems irresistible that this *Triticum dicoccoides* is indeed the primitive form of the Hard wheats. Most of the other specimens of *Triticum dicoccoides* which I could examine corresponded

to the coarser, pubescent, dark, and black-awned races of Hard wheats, such as "*africanum*," "*niloticum*," or "*libycum*," although in some cases the approach was not so strikingly close. But if *Triticum dicoccoides* gave rise to the Hard wheats, it also gave rise to the Emmers, only that in the Emmers the spindle remained brittle, the grains tight in the husks, and the grain shell thin, while the spindle hairs were much reduced or all but disappeared, so that the Emmers represent an evolution parallel to that of the Einkorn. The common origin of the Hard wheats and Emmers from the wild wheat of Palestine also suggests the possibility of the evolution of Hard wheats from Emmers as the more primitive of the two series. Schweinfurth not only suggested this a few years ago, but he actually found in wheat from the tombs at Abusir in Egypt a few Emmer heads with partially tough spindles. More than that, the spindles were villous along their edges, as in some of the Hard wheats. Hard wheat represents no doubt one of the oldest races of wheat, although so far not many authenticated cases of very old finds have been recorded. Still, it has been discovered in several Egyptian tombs, and at Hissarlik in a stratum overlying the ruins of Troy. Being essentially a warm-country wheat, it is not surprising that it has not been met with in the prehistoric strata of Central Europe. But probably this wheat spread early over the whole of North Africa, where, as also in Spain, it is represented by very numerous races. Hard wheat is also found in Abyssinia, and eastwards as far as India, and, what is significant, accompanied in both countries by Emmer and forms intermediate between Emmer and Hard wheat. It may also have reached Southern Europe in remote times; but there seems to be no definite evidence, the earliest reliable records dating from the sixteenth century.

We are better informed as to the early history of Emmer. According to Schweinfurth, Emmer and six-rowed barley were the common cereals of ancient Egypt, where the former has been found in considerable quantities and in an excellent state of preservation. At Abusir, for instance, Emmer chaff was used along with other materials for filling up the tombshaft, and at Gebelên, in the tomb of Ani, Maspero found satchels made of grass and filled with fruits and Emmer spikes. These finds take us back to about 2000 B.C. Emmer is also recorded from the neolithic lake dwellings at Wangen, and from those of Auvernier and the Petersinsel, all in Switzerland, the last two being of Bronze Age. More recent, but still dating back to the first centuries of our era, is the Emmer of Aquileia. The ancient Romans and Greeks knew it, and there is now little doubt that it was the *Adoreum* or *Far* of the Romans and the Ζέα or Ὄλυρα of the Greeks, or at least of most of the Greek writers. In the famous Codex of

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Dioscorides at Vienna, an illustrated manuscript of Dioscorides' *Materia Medica,* a wheat is figured to illustrate the paragraph on χόνδρος, a kind of pearl-barley prepared from the Ζέα δίκοκκος and this wheat is apparently an Emmer with a somewhat stout head. It is certainly not a Spelt proper, *Triticum Spelta,* which is usually considered to have been Ζεά or Ὄλυρα of Greek literature. To-day the cultivation of Emmer is confined in Europe to a few districts in South Germany, Switzerland, Spain, Italy, and Servia. In Egypt we find it mentioned under the name of *Triticum Spelta* as being grown near Alexandria until the 'forties of the last century; but since then it seems to have disappeared from there as from other parts of the Orient. On the other hand, it still has, as already stated, a hold in Abyssinia with its old and conservative civilisation, and to a very limited extent in India, where it was probably introduced long ago by Mohammedan traders. The Hard wheats lead us naturally to the so-called English wheats, or the *Triticum turgidum* stock, and the Polish wheats.

The English wheats are, like the Hard wheats, warm-country wheats, and have no doubt the same origin. Schweinfurth mentions *Triticum turgidum* among the cereals of ancient Egypt, and Unger believed he recognised it in a spindle fragment which he found in a brick from the walls of the ancient town of Eileythia. Beyond this there is practically nothing known about its early history. It has probably originated along with the Hard wheats. Still less is known in this respect about the Polish wheats. Koernicke, in his "Handbuch der Getreidekunde," considered it as a very distinct sub-species, which he opposed to all the other wheats taken together; Hackel even treats it as a distinct species. But in a posthumous paper just published, Koernicke recognises the Polish wheats as mutations from Hard wheats, characterised by the over-development of the outer or involucral glumes; various North African Hard wheats certainly support this view very strongly. Polish wheat is first mentioned in the seventeenth century; although it may not have been known to the Greeks, it is probably of much earlier origin than is generally assumed, as it is represented in Abyssinia by several marked races. Outside of Africa its cultivation is confined nowadays to Italy and Spain.

We have so far accounted for the two wild wheats, the Einkorn, the Emmer, the Hard, the English and Polish wheats. Their relations and early history may be considered as fairly established. It is different with the Soft and the Dwarf wheats, which have this in common and in contradistinction from the Hard wheats, that the outer or involucral glumes are keeled only in the upper part but rounded below. The Soft wheats are extremely numerous, and show perhaps a greater range of variation than the others.

They occur in our day wherever wheat is grown, although they are not always the predominant race. They are believed to have formed the bulk of the "Πυρός" of the ancient Greeks and of the *Triticum* of the Romans. Many finds in neolithic strata all over Europe have been assigned to them, so that the Soft wheats would appear to be as old as any. But there is this double difficulty, that the descriptions of the ancients are too vague to guide us, while the actual finds consist exclusively of loose grains, varying very much in size and shape. Buschmann enumerated not less than twenty-two places in Europe where prehistoric grains assigned to *Triticum vulgare*—that is, the Soft wheat group—had been discovered; of these more than one-half (thirteen) belong to the neolithic age. Considering, however, the difficulty of identifying loose grains of these wheats, particularly if not very well preserved, we have to be on our guard against hasty conclusions concerning the dates and the extent of their cultivation in those remote times; in any case, they do not offer us a clue to their descent. Structurally, they are, no doubt, closely allied to the Hard wheats, but I doubt whether they have the same origin. Schweinfurth remarks that all the old Egyptian grains of this class which he saw were remarkably small. The same can be said of most of the neolithic grains of Central Europe, and of the two English prehistoric samples in the Kew Museum, while most of these grains are at the same time comparatively stout. These old small-grained races are probably nearer to the primitive form, but if so the latter has not yet been discovered.

With respect to the Dwarf wheats we are in a similar position. Although at present nowhere extensively grown, to judge from their present and past distribution they must have once been grown over a much larger area. They are said to have been found in several neolithic localities in Central Europe; here again the finds, with two exceptions, consisted of grains only. These exceptions are some ears and spikelets from the Swiss lake dwellings, described by Heer as *Triticum vulgare antiquorum*, and some spikelets from the same localities referred by him to *Triticum compactum*. The latter resemble, according to Heer, the ordinary Dwarf wheat of modern Switzerland so much that he did not hesitate in identifying them with it. The other, however, his *Triticum vulgare antiquorum*, is quite distinct. The ears, although not intact, are splendidly preserved as far as they go. Their grains—usually three to four in each spikelet—are very small and stout. Other still more rounded grains from the neolithic and Bronze period of Central and South Europe have been described as *Triticum compactum* var. *globiforme* by Buschmann. Here again we have, as in the Soft wheats, an indication that the primitive form must have been, unlike *Triticum dicoccoides*, a small- and probably stout-grained *Triticum* at present unknown.

Both the Soft and the Dwarf wheats date back to equally remote times, both show a similar distribution in the past, and their general structural resemblance is sufficiently great to suggest a common origin. What it was we know not. Their primitive form will probably one day be traced back to a third species of wild wheat and to an area not very far distant from that whence the Emmer and Hard wheats came. Here, at any rate, is ample scope for further exploration.

The last of the wheats with which I have to deal is the Spelt proper, *Triticum Spelta*. Its origin has so far been quite obscure. It is mostly considered to have descended from Emmer, although the structure of its axis and its glumes lend little support to that theory, which probably had its origin in the early confusion of the popular names of the Spelt wheats. Spelt has so far never been found in any of the prehistoric settlements. Even its name Spelta was unknown until A.D. 301, when it appears for the first time in an edict by the Emperor Diocletian. It probably came to the Romans from the Germans, as Gradmann suggested in 1901. Since then, in a monograph, "Der Dinkel (Spelt) und die Alamannen," he has produced strong evidence that Spelt was the staple grain of the Alamans, who brought it with them into South and West Germany from their old home east of the Elbe. From there it would have spread to the Alps, Italy, France, and Northern Spain. Gradmann's expression "east of the Elbe" has evidently to be taken in a wide sense, as there is no grass in Eastern Germany or Western Russia from which Spelt could have descended. But still further east, or rather south-east, around the northern shores of the Black Sea, whence the Alamans may very well have come originally, a species of *Ægilops* occurs, *A. cylindrica* or *Triticum cylindricum*, which comes structurally so near to the Spelt that I feel almost convinced that it is the primitive form of the latter. The usual slender forms of *Triticum cylindricum* are perhaps not so suggestive in this direction; but occasional stouter specimens approach very closely to it in the nature of the spindle, the texture and the cut of the outer glumes and the curiously protruding inner or floral glumes. Moreover, there is at Kew a specimen of *Triticum cylindricum* raised from seeds found among grain refuse in the Leith Docks, near Edinburgh, which might be taken for a pubescent but otherwise almost typical Spelt, except for the characteristic awns of the terminal spikelet. This theory of the descent of Spelt from *Triticum cylindricum* does not exclude the possibility of early crossing with true wheats, as some of the peculiarities of Spelt suggest. For all we know, the Leith casual may be a cross between *Triticum cylindricum* and a pubescent true wheat, similar to the hybrid of *Triticum Spelta* and a pubescent unbearded wheat, described by Koernicke as *Triticum Spelta* var. *recens*.

To summarise briefly, we have traced the wheats to four primitive types: (1) the Einkorn, to *Triticum ægilopioides*, with its original home in Asia Minor and the north-eastern Balkans; (2) the Emmer and the Hard wheats, including the English and Polish, to *Triticum dicoccoides*, in Palestine; (3) the Soft, and probably also the Dwarf wheats, to a still unknown species, either in Syria or in Mesopotamia; and (4) the Spelt, to *Triticum cylindricum*, in an area extending from Bulgaria through Roumania to Southern Russia. From this standpoint the practical division into Spelt wheats and wheats proper breaks down entirely. Einkorn and Spelt proper, with their respective primitive forms, will have to stand as distinct species in any case; while it may be left an open question whether all the others should be treated under one or two species until we know the primitive form of the Soft and Dwarf wheats, and are able to gauge its taxonomic value as compared with *Triticum dicoccoides*.

I have so far tried to remain on ground which allows us to work with tangible material and by way of comparing actual specimens. It will now be interesting to sift the available experimental evidence and perhaps to start a new series of experiments on the basis of my propositions. Above all, however, it is desirable that the efforts to trace the distribution of the primitive wheats and discover new wild forms should be continued. In the first place, there can be now no doubt where to look for the latter. The statement of the Assyrian historian Berosus that wheat grew wild on the banks of the Euphrates, and Olivier's observation to the same effect made more than 2,000 years later, cannot, after Aaronsohn's discoveries, be treated any longer as negligible, especially as Olivier's location of the place where he found wild wheat associated with wild barley and "Spelt" is so precise that there ought to be no difficulty in visiting and examining it again. Another point which I would impress is the necessity of collecting without delay good samples of all the wheats—whole plants, as well as grains—which are grown in the Old World, particularly in the districts not yet much affected by the introduction of modern races. Many of the more primitive races are no doubt still in cultivation, and if not secured in time they will be lost for ever. The Balkan Peninsula, Asia Minor—in fact, the whole of the Orient—should be searched, and the same applies to Abyssinia, to Central Asia and China. I have so far not mentioned the Chinese wheats, although wheat is grown more extensively in China, particularly in the north and west, than is generally understood, and although it has been known to the Chinese for a very long time—at so early a period, indeed, that Count Solms-Laubach saw in this fact one of the arguments for his contention that the wheats were of Central Asiatic origin. Besides making systematic collections of the wheats grown at

present, it will also be necessary to search for, preserve, and carefully study every spike, spikelet, or grain sample found in the course of excavations of ancient sites, and to catalogue, examine, and compare whatever there may exist of old pictorial representations of cereals. We shall then, by the concentrated efforts of the collector, the botanist, and the archæologist, be in a better position to reconstruct the process of evolution which has led from a few wild grasses to the vast number of cultivated races which to-day we comprise under the name of wheats. This is a process which claims the attention not only of the botanist, but of all of us who, beyond our professional spheres, are accustomed to give a thought to the wider and deeper problems of the history of civilisation. The evolution of the cereals occupies the foremost place in the rise and onward march of agriculture all over the world. That of the wheats—with their immediate allies, the barleys and ryes—is especially closely associated with the white races; it is like a keystone in their making, it runs in their blood. With the ancients the cereals were the gifts of the gods. Isis gave wheat and barley to Egypt; as Demeter she took them to Greece, as Ceres to Latium. A wreath of wheat ears crowned her head, in Egypt as well as in Hellas and Rome. To go to the other end of the old Old World wheat area, the Chinese also received it "from Heaven," or, as other legends have it, from their half-mythical Emperor Shen-nung, who in the very dawn of Chinese history taught them to till the ground and raise the "wu ku," the five grains. Among them, holding the second place, was "mai," which originally stood for wheat and barley, and later on, according to Bretschneider, with or without the qualifying "siao" (little), for wheat alone. Thus as the Egyptian myths made Isis introduce wheat and barley simultaneously, so in China the "mai" which the Emperor Shen-nung sowed covered both. Similarly the Ζειά, the primitive wheat of ancient Greece, is etymologically equivalent to the sertic and avedic yava, which in another direction gave rise to "djau," the Persian name for barley, while the Latin *far,* the synonym of Ζεά, corresponds to the Gothic *barizeins* and Anglo-Saxon *bere* for barley. This is remarkable, and becomes very significant in the face of Aaronsohn's and Olivier's observations to the effect that the wild wheat and the wild barley are closely associated in their natural habitats. It is like an echo from the dim mythical past, telling us that wheat and barley are twins of one home and one age. Myths are like dreams, but even dreams have their kernels of truth. Diodorus Siculus, a Greek historian and contemporary of Cæsar, records the following legend: "Osyris, whose home was at Nysa, in that part of fertile Arabia which is not far from Egypt, loved agriculture, and he found the vine in the neighbourhood of Nysa. This shrub was

growing there wild, abundant, and hanging from the trees. Here also Isis found wheat and barley, growing haphazard in the country among the other plants, but unknown to man." Diodorus further says that there was at Nysa a column, with a hieroglyphic inscription commemorating Isis' discovery; the inscription ran: "I am the queen of all this country. I am the wife of Osiris and his sister. I am she who has first taught man to know the cereals. I am she who resides in the constellation of the dog. O rejoice, Egypt, thou my nurse." Where is, then, this fabulous Nysa, the home of wheat and barley? Pliny identifies it with Scythopolis, but Scythopolis is none other than Bethshean, a town west of the Jordan and not many miles south of the Sea of Galilee, in the trend of the same hills which, fifty miles further north, to this day bear the wild wheat and the wild barley "growing haphazard in the country among the other plants." Where, if not here, has ever any myth come true? Isis' column at Nysa has fallen, but her golden treasure has borne millionfold and conquered the world wherever the white man went; when you go through your wheat-fields and think of Isis, your great benefactress, you will hear out of the rustle of the ears the gentle voice of the dark-eyed goddess: "Rejoice, rejoice."

CONCLUDING REMARKS.

Various points were dealt with in the discussion which took place after the speakers had summarised their communications; for the most part these are covered by the Papers printed above.

It will be clear from these how numerous are the issues raised, how important and how infinitely difficult are the problems which still have to be solved before it can be said that we understand wheat; breed, soil, climatic conditions, public requirements, and economic considerations are all factors of primary importance, which not only must be taken into account but often balanced against one another.

The Rothamsted experiments afford much information as to the food requirements of the wheat plant, but the data may be said to be chiefly statistical. At present we know little or nothing of the actual composition of the grain; we are unable to say to what extent it always approaches a certain general average. We are unable to estimate the starch in wheat with any degree of accuracy, and we determine nitrogen in it without any reference to the forms in which the nitrogen is present. A great field of useful work is open to those who will endeavour to devise analytical methods which will make it possible to discuss the food value of cereal products in relation to their ultimate composition.

The discussion to which the determination of the strength of flour has given rise is of great interest in many respects, but

there is considerable difference of opinion between those who look at the subject from the practical side and those who are seeking to give an explanation of the mysterious behaviour of gluten. Great stress is laid upon the amount and quality of the mineral matters in flour, but in practice, in making bread, a considerable amount of salt is added, and therefore the mineral matter in the flour cannot alone be counted as effective.

The question, after all, is one of behaviour under practical conditions.

Dr. Hardy argues that gluten *per se* has no tenacity, but this is equally true of clay—probably the tenacity of clay is the tenacity of water: the individual particles are associated with water molecules and these water molecules serve to cement the particles together—in flour, as in clay, the individual particles differ, and there are differences between flours as there are between clays. At present strong flours are fashionable and are preferred, but there is no proof that they are of special value except from the point of view of fashion. Strong flours cannot be grown everywhere, and the question will arise whether, instead of seeking to produce strong flours everywhere, it will not be rather a question of so improving the baker's art that he will be able to avail himself more fully than is now the case of the various qualities of flour that may be produced; it is difficult to imagine that the food value of different flours can be very different.

When the time comes, in Canada and elsewhere, that the soil is less suitable for wheat cultivation, when the country is more fully developed, it will be necessary to introduce a more complicated system of agriculture; wheat will no longer receive almost sole attention, although it should always remain the most important crop. The farmer should be prepared and willing to take advantage of scientific knowledge in anticipation of such a change.

In closing the meeting, the Chairman said that one effect of the discussion should be to impress on the city of Winnipeg that the problems of agriculture deserved to be taken seriously in hand. Many who had been in the city during the week had been impressed by the way in which the streets and roads were cared for. Winnipeg, he said, taxed itself to grow fine roads; the question he desired to raise was: Should it not tax itself to grow fine wheat? He thought it was the one place where a tax might be imposed on wheat in order to support a real University in which wheat could be studied from every possible point of view. He thought no better form of insurance could be effected, and he ventured to take the opportunity of making the suggestion in all seriousness to the city of Winnipeg.

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INFLUENCE ON THE PRODUCTION OF MUTTON
OF
MANURES APPLIED TO PASTURE.

BY

WILLIAM SOMERVILLE, M.A., D.Sc.,

Sibthorpian Professor of Rural Economy, University of Oxford.

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PREFACE

The experiments in the Manuring of Poor Pasture Land, described in this Report, were designed in the first instance by Professor Somerville, and were commenced in 1896 under his supervision at the Northumberland County Demonstration Farm at Cockle Park. In 1898, Professor Somerville submitted to the Board of Agriculture and Fisheries a preliminary report which showed the necessity for further experiments on similar lines, and in the following year the Board approached several public bodies with a view to the organisation of experiments in different parts of Great Britain. Eventually arrangements were made with the Bath and West and Southern Counties Society, the Highland and Agricultural Society of Scotland, and the Agricultural Department of the University of Cambridge, by which those bodies agreed to undertake the further experiments required, a substantial contribution being made by the Board towards the expenditure entailed. The aggregate sums paid by the Board for the purpose during the past ten years have amounted to £2,055, in addition to which the Board have made an Annual Grant towards the general expenses of maintaining the Cockle Park Experiment Station.

The result of these experiments has shown that the conclusions which were drawn from the original Cockle Park experiment, and the recommendations made, are applicable to very large areas of pasture land in this country.

Up to the present, however, although these results have been communicated to the public through the medium of separate Bulletins issued by the Institutions carrying out the experiments, no general summary or review of the trials as a whole has been available.

The Board therefore suggested to Professor Somerville

that it would be desirable that he, as the author and originator of the experiments, should prepare a Report which would bring together in one publication the results obtained during the last fourteen years.

In publishing the Report which Professor Somerville has been good enough to prepare, and for which the Board desire to express their grateful acknowledgment, the Board would draw the attention of farmers to the practical and valuable character of the results obtained.

Briefly, they may be said to show (1) that certain well-marked types of poor pasture land may be so improved by the use of phosphatic manures, and especially by the application of basic slag, as to enable the land to carry a much larger head of stock than before; and (2) that this improvement can be effected at a relatively small expense, and usually results in a substantial profit.

BOARD OF AGRICULTURE AND FISHERIES,
WHITEHALL PLACE, S.W.
January, 1911.

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INFLUENCE ON THE PRODUCTION OF MUTTON OF MANURES APPLIED TO PASTURE.

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It is doubtless within the knowledge of most farmers, and of others who take an interest in agriculture, that during recent years a considerable amount of experimental work has been in progress throughout Great Britain, the object of which has been to ascertain the results of the manuring of pastures, such results being obtained not in terms of herbage, but of live-weight increase. Up to the year 1897 no experimental work on these lines had ever been undertaken at home or abroad. The experimental station at Rothamsted, the leading agricultural societies, and certain agricultural colleges and private individuals had, of course, carried out numerous tests with manures on grass-land, but these tests were, for the most part, conducted on meadows; or, if on pasture, then stock was excluded for the time being, the herbage was allowed to grow unchecked till mature, when it was weighed, and the experiment, though nominally on a pasture, was really on a hay-field. In the first season of such an experiment, on land hitherto used for grazing, the character of the herbage will not be much affected by the exclusion of stock—and especially so if it is cut before it is quite mature—but in the course of a few years the relative abundance of the various species of plants will alter considerably, and the results obtained will be less and less applicable to pastures. The finer grasses, clovers, and other dwarf plants, that secure sufficient light and air in a close-cropped pasture, are rapidly crowded out, or

greatly diminished, where more vigorous species are allowed to grow unchecked, as they are in a hay-field, and it is usually supposed that it is the former plants which, to a large extent, give "quality" to a pasture.

It appeared to be desirable, therefore, that experiments designed to illuminate the problem of the improvement of grazing ground should be conducted on pastures, and not on meadows or hay-fields, and one way in which it seemed that this could be satisfactorily done was to determine the results of treatment by ascertaining what live-weight increase this treatment could produce on animals grazing the pasture.

Judged by the area occupied by the various crops grown in Great Britain, grass is much the most important of all. In 1910 permanent grass covered nearly 17½ million acres, while rotation grass (including clover and sainfoin) extended to nearly 4¼ million acres. Of the permanent grass 12½ million acres were grazed, while only a little over 5 million acres were used for hay. Of the temporary leys about half was grazed and half was hayed. Of nearly 22 million acres, therefore, under permanent and temporary grass (including clover and sainfoin) nearly 15 million acres were used as pasture, as contrasted with 7 million acres devoted to hay. The pastured area of Great Britain, in fact, nearly equalled the total area of tillage land, the figures being 14,554,168 and 14,667,224 acres respectively. Nor does this exhaust the case for pastures, for besides the 15 million acres just referred to there are nearly 13 million acres classed as "Mountain and Heath Land used for Grazing," or a grand total of between 27 and 28 million acres of pasture of one kind and another.

Much of this great area is probably incapable of profitable improvement: some because it is already near the upper limit of productiveness, and some because it is at such an altitude, or possesses such physical characters, as to preclude the hope of economic amelioration. But after making large deductions, there remains a vast extent of pasture of a kind that experiments and practice alike have shown to be capable of easy and profitable improvement, and it is this class of pasture which, alike in the interests of the individual and of the nation, should be speedily taken in hand. The experi-

ments about to be described indicate that certain types of land of low value can be made to carry double their present stock, and not only so, but each animal will produce much more meat in a grazing season. The meat-yield of such areas can therefore be more than doubled—in some cases quadrupled—with greatly increased profits to the occupier, and with much advantage to the country.

In the North of England, where the writer had the advantage of working through most of the "nineties," there are wide stretches of poor, high-lying, cold pastures that have gone out of cultivation during the past fifty years. It seemed to be not unreasonable to hope that such land could be profitably improved, and in a paper read before the Newcastle Farmers' Club in 1892,* the following suggestions were submitted for the consideration of the meeting:—

"What we want most of all in this country are agricultural experiments conducted on the following lines:—Given a certain area of grass-land of inferior feeding properties, and as equal as possible throughout, let it be divided into two-acre plots, and let duplicate plots be dressed with various kinds of manures, alone and in combination. Then accurately weigh a number of sheep and place four or five on each plot, and at the end of the summer let the various lots of sheep be weighed, so that we may ascertain how they have thriven. Let the same experiment be repeated each year on the same land—either with or without the application of additional quantities of manure—and at the end of ten years, if not sooner, information of a definite and most valuable description will be forthcoming."

Experiments at Cockle Park.

Partly with the view of providing facilities for the conduct of such an experiment, the County Council of Northumberland decided to lease a farm, and at Michaelmas, 1896, they entered on the occupation of Cockle Park, a farm on the Duke of Portland's estate near Morpeth. This farm of 400 acres is situated in a district whose main feature is second-rate grass-land, and about three-quarters of the farm itself is pasture of this description. A field ("Tree Field," Fig. 1)

* *The Manuring of Grass Land*, p. 8.

of 34 acres was selected for what has come to be known as the "Manuring for Mutton" experiment. It is situated on the lower part of the farm, at an altitude of about 300 feet, has a gentle slope to the north end, which is about 20 feet lower than the southern boundary, and is very uniform throughout. It consists of strong boulder clay, overlying the millstone grit of the carboniferous system. The plots were laid down to run east and west, a ditch on the east side providing each with water. The land had been down to grass for some 40 years, and was certainly not worth more than 5s. per acre per annum; in fact, many farmers said it was not worth half-a-crown. Samples of soil taken throughout the field in January, 1900, showed an average weight of practically 1 cwt. per cubic foot, and a water-content of 22.3 per cent. A chemical analysis, made by Mr. Hoare Collins, of the Durham College of Science (now Armstrong College), gave the results shown in Table I.

TABLE I.—Analysis of Unmanured Soil at the Commencement of the Experiments at Cockle Park, Sevington and Cransley.

	Cockle Park.	Sevington.	Cransley.
	Per cent.	Per cent.	Per cent.
Nitrogen	0·20	0·22	0·29
Total Phosphoric Acid	0·07	0·18	0·13
Do. sol. in 1 per cent. Citric Acid ..	0·005	0·013	0·013
Total Potash	0·50	0·56	0·57
Do. sol. in 1 per cent. Citric Acid ...	0·013	0·008	0·008
Total lime	0·70	2·87	0·63

These figures represent a perfectly normal soil, rather rich than otherwise in nitrogen and potash, but deficient in "available" phosphoric acid, and rather low in lime.

The herbage consisted chiefly of *Agrostis vulgaris* with a thin sprinkling of Sweet-scented Vernal, Briza, Dogstail, Yorkshire Fog, Yellow Oat Grass, Lotus, Luzula, etc.

In the autumn of 1896 the field was subdivided by means of suitable fences into 10 plots containing 3 $\frac{1}{20}$ acres each. An eleventh plot was also under treatment for some time, but as it does not really enter into the scheme of the experiment it need not be further regarded. The intention was to stock each main plot of 3 acres with sheep, and to enclose

FIG. 1.—THE TREE FIELD AT COCKLE PARK, LOOKING NORTH.

Plot 6 (continuously unmanured) in the foreground. Plots 7—10 are seen in the distance. Plots 1—5 are behind the spectator.

FIG. 2.—METHOD OF WEIGHING THE SHEEP. MR. ASHCROFT IS SHOWN READING THE DIAL.

a sub-plot of $\frac{1}{20}$ acre on each, on which the herbage could be allowed to grow up, thus giving an opportunity of ascertaining the results of the action of the manures in terms both of mutton and of herbage. Each year fresh areas were selected for the sub-plots, so that they came as near as possible to representing, in terms of "hay," the results of applying manures to *pasture*. It may also be mentioned at this point that a third method of assessing the results has been persistently followed throughout the experiment, namely, submitting the different lots of sheep at the end of each season to the unprejudiced judgment of an experienced butcher and salesman, who has put a valuation on the animals. It is satisfactory to find that the results, as determined by weighing the sheep, by the butcher's estimate, and by weighing the hay, and valuing it at 30s. per ton, are, for the most part, in close agreement. They are here set out for comparison, the figures referring to nett gain or loss per acre in nine years, after deducting the cost of cake and manure. Full details of the treatment that each plot received will be found in Table IV.

Plots.	1. Cake.	2. Lime.	3. Slag in 1 dose.	4. Slag in 2 doses.	5. Super.	7. Super & potash.	8. Super & lime.	9. Super & sul. am.	10. Dis. bones.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
By weighing .	1 6 *	10 2 *	17 2	13 9	10 0	9 3	12 2	5 3	8 0
By butcher's valuation .	2 10	10 8 *	13 1	12 1	7 2	7 4	10 6	1 3	6 10
By hay . .	3 3	5 6 *	22 2	15 0	8 0	6 8	10 3	8 11	9 11

* Losses. All other figures indicate gains.

The results have also, in a sense, been estimated by the hundreds of farmers who have annually visited the plots, and who have expressed their views as to the value of the improvements effected by the different systems of treatment. By way of illustrating the verdict of practical men on the results of treatment, it may be mentioned that certain farmers carefully valued the plots in the fifth year of the experiments, and while they put the grazing value of the untreated ground at 5s. per acre (Plot 6), they valued some of the treated plots at over 20s. per acre.

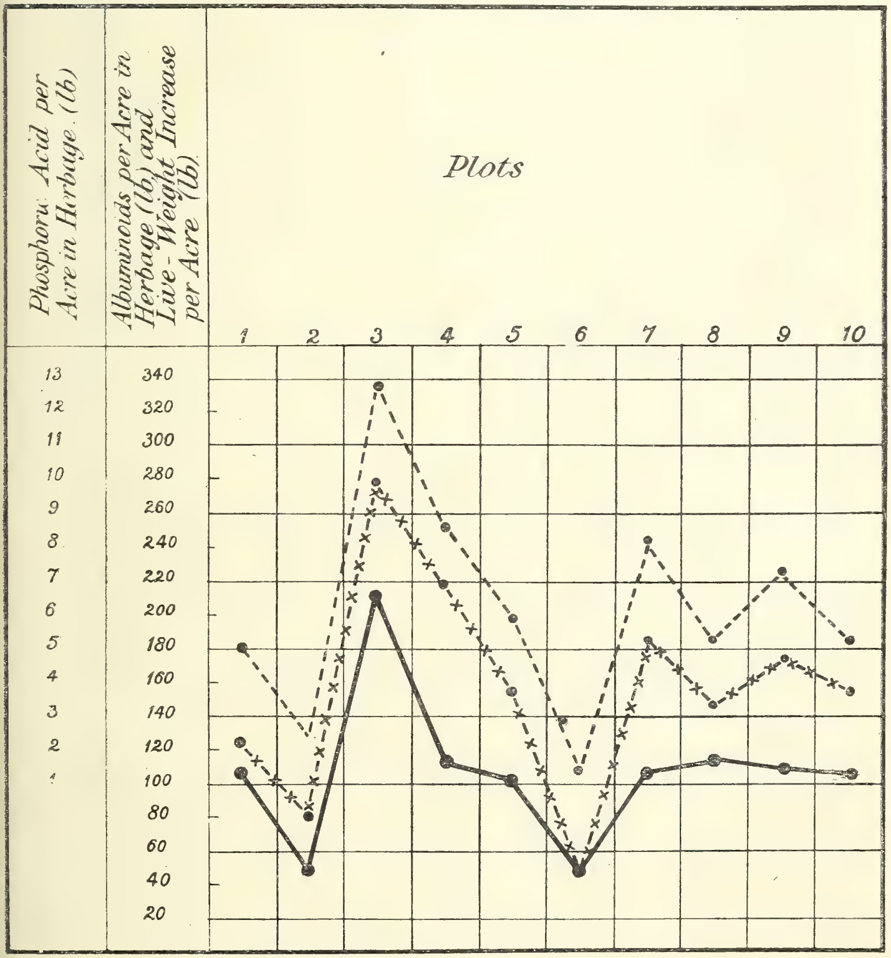
Other methods of reaching conclusions have also been adopted. In most years a sample of herbage of each sub-plot has been separated into its constituent species. It has been interesting to watch the gradual change that has been effected by treatment. On the best plots Agrostis has been much reduced, while better grasses, such as rye-grass, cocksfoot, and yellow oat grass, have taken its place. White clover was present in great abundance, especially in the second, third, and fourth years after basic slag was put on, after which it became less conspicuous. The accumulations of nitrogen stored up by the clover offered suitable conditions for the growth of gross-feeding grasses, like Yorkshire fog, which became rather conspicuous on some of the best plots.

In the third season (1899), when the action of most of the manures was at its maximum, samples of herbage from the sub-plots were chemically analysed by Mr. Hoare Collins. The complete figures will be found at p. 219 of the Report for 1900, and these supply valuable confirmatory evidence of the accuracy of the other methods of assessing the results. The percentage of albuminoids present in such a substance as grass is usually regarded as the best chemical index of its

TABLE II.—In the Third Season at Cockle Park, Co-relation of (*a*) Live-weight Increase, (*b*) Weight of Albuminoids, and (*c*) Weight of Phosphoric Acid in the Herbage, all per Acre.

Plots.	Treatment per acre.	Yields of		
		(*a*) Live-weight increase.	(*b*) Albuminoids.	(*c*) Phosphoric acid.
		lb.	lb.	lb.
1	Cake fed to Sheep 1897–98... ...	106	125	5·04
2	4 tons Lime	47	82	2·46
3	½ ton Basic Slag (200 lbs. P_2O_5) ...	211	278	12·85
4	¼ ton ,, (100 lbs. P_2O_5) ...	113	219	8·56
5	7 cwt. Super (100 lbs. P_2O_5) ...	103	155	5·96
6	Untreated	48	48	1·41
7	As for No. 5, with 50 lbs. K_2O for 1897 and again for 1899 ...	107	185	8·18
8	As for No. 5, with ½ ton Ground Lime for 1897 and again for 1899	114	147	5·23
9	As for No. 5, with ¾ cwt. Sul Ammonia (17 lbs. N.) for 1897 and 1899	109	174	7·19
10	6 cwt. Diss. Bones (100 lbs. P_2O_5 + 17 lbs. N.)	106	155	5·33

TABLE III.—Relationship between Live-weight Increase, Albuminoids and Phosphoric Acid per Acre at Cockle Park in the Third Year of the Experiments (1899).



Phosphoric Acid per Acre in Herbage -----------

Albuminoids " " " " –x–x–x–x–x

Live-Weight Increase per Acre ————

feeding properties. I have therefore taken this percentage, and, having regard to the weight per acre of herbage, estimated dry,* yielded in 1899 by the sub-plots, the actual weight of albuminoids per acre has been calculated. These figures are brought together on Table II., but they are more easily compared by reference to the curves on Table III., where it will be seen that the relationship of the live-weight increase to the quantity of albuminoids in the herbage is a very close one. On the unmanured plot (No. 6) 48 lbs. of albuminoids have produced exactly 48 lbs. of live-weight increase, and although in no other case do the figures actually coincide, as in Plot 6, the general agreement is very close. Still more striking is the close relationship between the weight per acre of phosphoric acid and the weight of albuminoids found in the herbage. The explanation, no doubt, is that the greater the amount of available phosphoric acid at the disposal of the plants, the greater is the weight of clover produced, and the greater the weight of clover, the greater the amount of albuminoids.

Of these various methods of valuation the one that will be chiefly discussed in this report is that which is based upon the determination of live-weight increase, as ascertained by weighing each individual sheep when the plots are stocked at the beginning of each grazing season—generally in the latter half of May—the weighing being repeated at the end of each month, and finally at the end of each season. Before weighing the sheep were fasted for 12 hours. The process of weighing is a very simple one, and is that which has been adopted at other stations laid down on similar lines. The method of performing the work is shown in Fig. 2. While each individual weighing is simple enough, the aggregation of all the weighings in this experiment, at Cockle Park alone, represents a large amount of work. In the 14 years with which this report deals, about 1,400 sheep have been employed. In the first nine years each animal was weighed monthly, but in the last five years the sheep have been weighed only three times during each season. This means, during the 14 years, about 6,000 separate weighings.

* The dry weight has been taken as 20 per cent. less than the hay weight.

Usually a special lot of sheep about 14–15 months old has been purchased at the beginning of the season for the purposes of this experiment. Sometimes the stock of the farm has been able to supply the necessary animals. Care has been exercised to get the animals as uniform as possible. If 80 sheep are required to stock the plots in any season about 100 are weighed, and the 10 heaviest and 10 lightest are at once rejected. Then the 80 are so distributed throughout the plots that all the lots of sheep are as similar in all respects as possible. When this is done with due care the disturbing factor of individual idiosyncrasies is largely eliminated. The animals have never shown any signs of lack of thriving caused by the limited character of their grazing area. The number of sheep placed upon each plot has been decided on the experience gained, and on the appearance of the herbage of the particular plot. A mere fraction of one per cent. have died or proved unsuitable in the course of the experiment. Each animal when placed upon the plots has been supplied with a "plot mark" and with an individual number. Tattooing the ears has been found to be the most satisfactory method of applying the individual mark, the insertion of clips or studs not being sufficiently reliable.

The financing of the work was undertaken by the Northumberland County Council, though the Board of Agriculture and Fisheries subsequently gave a general grant to the Armstrong College on account of the farm, the College, through its Agricultural Department, exercising detailed scientific supervision.

The original scheme provided for nine years work, but at the end of that period the experiments were continued with some small modifications, and are still in progress. In the first instance only the first period of nine years will be reviewed in this report. (See Tables IV. and XVII.)

Experiments at Sevington, Hampshire.

After the experiment had been in progress for three years the Board of Agriculture and Fisheries made arrangements with the Bath and West and Southern Counties Society for an exact duplication of the tests on poor pasture situated on the chalk, on a farm at Sevington, rented by Mr. James Stratton from the Tichborne estate, about two miles from Alresford, in

TABLE IV.—Results at Cockle Park, Northumberland, for Nine Years. The figures, in all cases, refer to an Acre.

Plots.	Treatment per Acre.	Cost of Treatment.	Live-weight Increase. Gross L.-W. Increase.	Live-weight Increase. Excess over Plot 6.	Live-weight Increase. Value at 3d. per lb.	Live-weight Increase. Nett Gain (+) or Loss (−) in 9 years.	Live-weight Increase. Nett Gain (+) or Loss (−) per Acre per annum.	Nett Gain (+) or Loss (−) per Acre per annum, by Butchers' Valuation.	Hay Yield. Gross Yield of Hay in 9 years.	Hay Yield. Excess over Plot 6.
		£ s. d.	lb.	lb.	£ s. d.	£ s. d.	s. d.	s. d.	cwt.	cwt.
1	Sheep consumed $\frac{1}{2}$—1 lb. per head per day of Dec. Cot. Cake in 1897, '98, 1903, '04, a total of $21\frac{1}{4}$ cwt. (168 lb. N.)	8 10 0	960	626	7 16 6	− 0 13 6	− 1 6	+ 2 10	175	97
2	4 tons Lime 1897, and again 1903	6 0 0	447	113	1 8 3	− 4 11 9	− 10 2	− 10 8	112	34
3	10 cwt. Basic Slag 1897 (200 lb. P_2O_5) ...	1 5 0	1,053	719	8 19 9	+ 7 14 9	+ 17 2	+ 13 1	227	149
4	5 ,, ,, ,, 1897 and again 1900 ..	1 5 0	928	594	7 8 6	+ 6 3 6	+ 13 9	+ 12 1	185	107
5	7 ,, Super 1897, and again 1900 (200 lb. P_2O_5)	1 18 6	847	513	6 8 3	+ 4 9 9	+ 10 0	+ 7 2	150	72
6	Untreated throughout	—	334	—	—	—	—	—	78	—
7	Super as on Plot 5, with 2 cwt. Sul. Pot. 1897, '99, 1903 (150 lb. K_2O)	3 4 6	926	592	7 8 0	+ 4 3 6	+ 9 3	+ 7 4	159	81
8	Super as on Plot 5, with 10 cwt. Ground Lime, 1897, '99, 1903	3 8 6	1,047	713	8 18 3	+ 5 9 9	+ 12 2	+ 10 6	186	108
9	Super as on Plot 5, with 84 lb. Sul. Am. 1897, '99, 1900, '03 (68 lb. N.)	3 14 6	820	486	6 1 6	+ 2 7 0	+ 5 3	+ 1 3	182	104
10	6 cwt. Dis. Bones, 1897 and again 1900 (200 lb. P_2O_5 and 34 lb. N.)	3 6 0	887	553	6 18 3	+ 3 12 3	+ 8 0	+ 6 10	181	103

Hampshire. (Table V.) The field, which is 200–300 feet above sea level, is fairly steep, and slopes to the south-east. Each plot runs from the bottom of the field to the top, and all are alike as regards shelter. In the upper part of the field the chalk is covered with the usual sticky red clay, containing numerous flints, while across the middle of the field the chalk comes within two or three inches of the surface. In the lower part of the ground the chalk is obscured by loamy soil mixed with flints. Each plot contains an equal proportion of these three kinds of soil. The supply of the manures was undertaken by the Agricultural Department of the University of Cambridge, which also made all analyses, both chemical and botanical, except where otherwise stated. Samples of soil were taken in the first year from all the plots, and showed the average results stated in Table I.

The nitrogen, it will be observed, is practically the same in amount as at Cockle Park, as also is the total potash, though the "available" potash is little more than half as great. Both the total and "available" phosphoric acid (as determined by Dyer's method) are more than twice as abundant as at the Northumberland station, while lime, as was to be expected on soil derived from chalk, is four times as plentiful. At the commencement of the experiment the land had been under grass for eight years. The herbage was of an entirely different character from that at Cockle Park, as will be seen from the following statement of a few of the leading plants on Plot 6 (unmanured throughout) at both stations:—

	Cockle Park.	Sevington.	Cransley.
	Per cent.	Per cent.	Per cent.
Agrostis	66	0·9	1·8
Cynosurus cristatus	0·1	9·8	39·4
Dactylis glomerata	12·4	24	2·0
Lolium perenne	0	15·6	10·0
Medicago lupulina	0	33·6	3·4
9 years average weight of hay (cwt. per acre)	8½	19½	6¼ *
Do. live-weight increase (lb. per acre) ...	37	106	44 *

* Eight years at Cransley.

Although accounted a poor pasture, this Sevington land is naturally far superior to that at Cockle Park. The class of plants is much better, while the yield of hay and production

TABLE V.—Results at Sevington, Hants, for Nine Years. The figures, in all cases, refer to an Acre.

Plots.	Live Weight Increase in 1900, when all Plots were Untreated.	Treatment per Acre.	Cost of Treatment.	Live Weight Increases. Gross L. W. Increase.	Excess over Plot 6.	Value at 3*d*. per lb.	Nett Gain (+) or Loss (–) in 9 Years.	Nett Gain (+) or Loss (–) per Acre per Annum.	Hay Yield. Gross Yield of Hay in 9 Years.	More (+) or Less (–) than Plot 6.
	lb.		£ *s*. *d*.	lb.	lb.	£ *s*. *d*.	£ *s*. *d*.	£ *s*. *d*.	cwt.	cwt.
1	71	Sheep consumed ½–1 lb. per head per day of Dec. Cot. Cake in 1901, '02, '07, '08, a total of 15 cwt. (120 lb. N.)	6 0 0	1,395	441	5 10 3	– 0 9 9	– 1 1	156	– 20
2	74	4 tons Lime 1901, 5 cwt. Basic Slag 1907 ...	3 12 6	1,167	213	2 13 3	– 0 19 3	– 2 2	155	– 21
3	69	10 cwt. Basic Slag 1901 (200 lb. P_2O_5) ...	1 5 0	1,410	456	5 14 0	+ 4 9 0	+ 9 11	262	+ 86
4	73	5 ,, ,, ,, 1901, and again 1904 ...	1 5 0	1,359	405	5 1 3	+ 3 16 3	+ 8 6	284	+ 108
5	65	7 cwt. Super 1901, and again 1904 (200 lb. P_2O_5)	1 18 6	1,356	402	5 0 6	+ 3 2 0	+ 6 9	252	+ 76
6	81	Untreated throughout	—	954	—	—	—	—	176	—
7	74	Super as on Plot 5, with 2 cwt. Sul. Pot., 1901, '03, '07 (150 lb. K_2O)	3 4 6	1,407	453	5 13 3	+ 2 8 9	+ 5 5	296	+ 120
8	74	Super as on Plot 5, with 10 cwt. Ground Lime, 1901, '03, '07	3 8 6	1,389	435	5 8 9	+ 2 0 3	+ 4 6	265	+ 89
9	67	Super as on Plot 5, with 97 lb. Sul. Am., 1901, '03, '04, '07 (80 lb. N.)	4 0 0	1,230	276	3 9 0	– 0 11 0	– 1 3	295	+ 119
10	78	6 cwt. Dis. Bones, 1901, and again 1904 (200 lb. P_2O_5 and 40 lb. N.)	3 6 0	1,296	342	4 5 6	+ 0 19 6	+ 2 2	278	+ 102

of mutton are 2–3 times as great. The rental value may be put at nearly 10s. per acre. The labour involved in carrying through the experiment was practically the same at both stations, and those responsible for the experiment were extremely fortunate in securing the services of Mr. W. Ashcroft, Steward of the Bath and West Society, as supervisor of the work.

Before putting on any manure a season's grazing (1900) of the plots was undertaken in order to ascertain the natural variations of the land unaffected by any treatment. The result of this preliminary test showed (see Table V.) that the live-weight increase was lowest on Plot 5 (65 lbs. per acre) and highest on Plot 6 (81 lbs. per acre). In a sense it was fortunate that this latter plot should have proved to be naturally the best, seeing that it remained unmanured throughout the experiment, and was the basis of comparison for all the others. This ensures that the effects of the treatment applied to the other plots are in no way due to their condition.

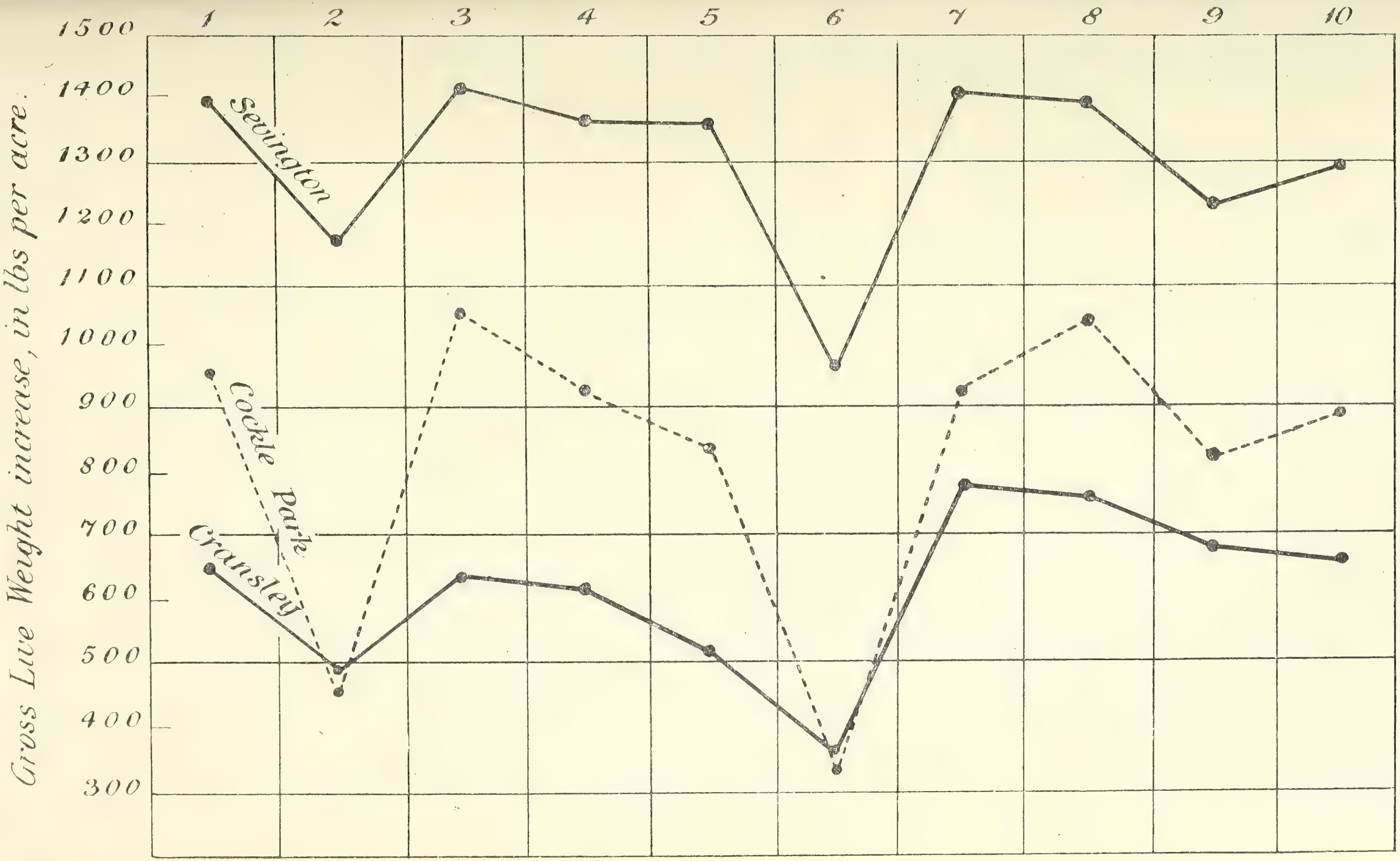
Experiments at Cransley, Northamptonshire.

In the same year as that in which experiments were commenced at Sevington, arrangements were entered into between the Board of Agriculture and Fisheries, Cambridge University, and Northampton County Council for starting a duplicate station in Northants. Land was secured on a stretch of poor boulder clay at Cransley, about four miles from Kettering, at an altitude of 450–500 feet above sea level, and ten plots were laid down as at the other centres. The field had been down to grass for some 20 years, and its value may be put at 10s. per acre. As in the case of Sevington, the soil of every plot was sampled and analysed at the start of the work, the average figures being shown in Table I. Except that the soil at Cransley is rather deficient in lime, it shows a very close resemblance to that at Sevington. The botanical composition of the herbage in 1905 as regards certain species is shown on page 11, where it will be seen that Crested Dogstail is the predominant grass. The average weight of hay on the unmanured plot is only 6¼ cwt. per acre, while the average live-weight increase on the untreated plot is 44 lbs. As regards natural productiveness, therefore,

TABLE VI.—Results at Cransley, Northants, for Eight Years. The figures, in all cases, refer to an Acre.

Plots.	Live Weight Increase in 1900, when all Plots were Untreated.	Treatment per Acre.	Cost of Treatment.	Live Weight Increase. Gross L.W. Increase.	Live Weight Increase. Excess over Plot 6.	Live Weight Increase. Value at 3*d.* per lb.	Live Weight Increase. Nett Gain (+) or Loss (−) in 8 Years.	Live Weight Increase. Nett Gain (+) or Loss (−) per Acre per Annum.	Hay Yield. Gross Yield of Hay in 8 Years.	Hay Yield. Excess over Plot 6.
	lb.		£ *s.* *d.*	lb.	lb.	£ *s.* *d.*	£ *s.* *d.*	*s.* *d.*	cwt.	cwt.
1	56	Sheep consumed $\frac{1}{2}$–1 lb. per head per day, Dec. Cot. Cake in 1901, '02, a total of $6\frac{2}{3}$ cwt. (54 lb. N.) 10 cwt. Basic Slag (200 lbs. P_2O_5) applied for 1907	3 18 6	647	295	3 13 9	− 0 4 9	− 0 7	145	94
2	48	4 tons Lime 1901, 10 cwt. Basic Slag 1907	4 5 0	479	127	1 11 9	− 2 13 3	− 6 8	127	76
3	53	10 cwt. Basic Slag 1901 (200 lb. P_2O_5) ...	1 5 0	632	280	3 10 0	+ 2 5 0	+ 5 7	117	66
4	56	5 ,, ,, ,, 1901 and 5 cwt. for 1904 (200 lb. P_2O_5)	1 5 0	609	257	3 4 3	+ 1 19 3	+ 5 0	115	64
5	55	7 cwt. Super. 1901, and 7 cwt. 1904 (200 lb. P_2O_5)	1 18 6	521	169	2 2 3	+ 0 3 9	+ 0 6	99	48
6	54	Untreated throughout...	—	352	—	—	—	—	51	—
7	50	Super as on Plot 5, 2 cwt. Sul. Pot., 1901, 1903 and 1907 (150 lb. K_2O)	3 4 6	775	423	5 5 9	+ 2 1 3	+ 5 2	179	128
8	57	Super as on Plot 5, and 10 cwt. Ground Lime, 1901, '03, '07	3 8 6	754	402	5 0 6	+ 1 12 0	+ 4 0	183	132
9	50	Super as on Plot 5, 70 lb. Sul. Am., 1901, '03, '04, '07 (56 lb. N.)	3 8 6	676	324	4 1 0	+ 0 12 6	+ 1 7	162	111
10	43	6 cwt. Dis. Bones, 1901 and 1904 (200 lb. P_2O_5 and 28 lb. N.)	3 6 0	653	301	3 15 3	+ 0 9 3	+ 1 2	117	66

TABLE VII.—Nine Years' Results at Cockle Park and Sevington; Eight Years' at Cransley.



Cransley approaches closely to Cockle Park. In the preliminary season's grazing without manures the live-weight increases per acre varied between 43 lbs. on Plot 10 and 57 lbs. on Plot 8. Plot 6 (the unmanured one) gave 54 lbs. per acre, which is slightly above the mean for the 10 plots. (See Table VI.)

This station proved to be rather an unsatisfactory one. The excessive rainfall of 1903 affected the plots somewhat unequally, and, in particular, Plot 5—in some respects the most important plot of all—was considerably injured. As a consequence, the results began to show undesirable irregularity, and the station was discontinued at the end of the eighth season. It is therefore not strictly comparable with the others throughout, but so far as it has gone it has yielded useful confirmatory results.

In Table VII. the nine years' results at Cockle Park and Sevington and the eight years' results at Cransley are represented graphically, in order to show how close is the relative agreement between the three stations. All the figures at Sevington are much higher than at Cockle Park and Cransley, but the trend of the figures is in all cases the same, with two exceptions, namely, that whereas at Cockle Park ground lime added to superphosphate has acted better than potash, similarly used, at Sevington and Cransley potash has done slightly the better. Also at Cransley dissolved bones have produced less mutton than a mixture of superphosphate and sulphate of ammonia, while at the other two stations the position is reversed.

Other experiments in England.

These three stations in Northumberland, Hants, and Northants being all of the same extent, and being, in fact, exact duplicates of each other, are chiefly relied on for the results that are about to be discussed, but certain smaller stations must also be referred to. For the season 1900 five plots of $3\frac{1}{3}$ acres each were put down on some very poor wet clay at Hatley, near Cambridge, and were continued for five years, namely, till the end of 1904. They were concerned with the effects of large and small dressings of basic

slag, with the comparative effects of slag and superphosphate, and with the results of using cake.

In the same year a similar set of plots, with one in addition, were put down on stiff clay pasture near Yeldham in Essex. The land proved rather unsuitable for sheep, and the experiments were discontinued after four seasons.

In order to test the effects of manures on pasture on gravel, some park land was taken in hand near Norwich in 1901, but as the sheep proved incapable of dealing with the coarse herbage that grew on this area, the experiment was discontinued after the second season.

Two plots, one unmanured and one treated with ½ ton basic slag, were put down by the East Suffolk County Education Committee in association with Cambridge University on poor boulder clay near Saxmundham for the season of 1905. By the kindness of the Committee I have obtained an abstract of the results for the past five years, and these will be referred to in due course.

These, so far as I know, are all the experiments of the type under consideration in England.

Experiments in Scotland.

In Scotland seven stations dealing with a limited number of problems were laid down in 1901. The selection and management of these stations was undertaken by the Highland and Agricultural Society of Scotland, in association with the Glasgow and West of Scotland College of Agriculture, the initiative having come from the Board of Agriculture and Fisheries, who made a money grant on account of equipment and maintenance. Six of these stations were carried on for seven years, including one preliminary year without manure. They were distributed throughout the following counties:—Berwick, Selkirk, Perth, Dumfries, Lanark, Kirkcudbright, and were generally placed on poor upland pasture, at altitudes varying from 600 to 1,200 feet. The standard size of plot was four acres, though at one station it was only three. The object of this series of stations was to ascertain how far the main results of the Tree Field experiment at Cockle Park were applicable to Scottish conditions. Two exhaustive reports have appeared in the Transactions of the Highland and Agri-

cultural Society of Scotland for 1905 and 1908, and these may be referred to for full details.

At Downan, in Ayrshire, an experiment was started by Professor R. Patrick Wright, of the West of Scotland College of Agriculture, in 1899, and was continued for six years. This station was situated close to the sea, though at an average altitude of about 100 feet. Each plot was three acres in extent, the annual value of the land being put at 10s. per acre. It had been under grass for about 80 years, and produced chiefly Agrostis and Sweet-scented Vernal. This experiment was conducted in precisely the same way as all the others, except that each plot really consisted of two portions of 1½ acres each, on which the sheep were grazed in alternate weeks. In this way it was thought the grazing would be more uniform, and that the pasture would be less fouled.

In 1905 Mr. R. B. Greig, of the Aberdeen and North of Scotland College of Agriculture, started two stations in Kincardine (Glen Dye) and Ross (Ardross) respectively. These were continued for five seasons, and were reported on by Mr. Greig in the present year. So far as the tests bear on the original scheme at Cockle Park, the results will be referred to in this report.

Publications dealing with the Experiments.

It is obviously impossible, as it is undesirable, to refer in great detail to the results of these various "Manuring for Mutton" experiments conducted during the past 14 years throughout England and Scotland. A note may therefore be made of the publication, where a summary of each may be found.

Cockle Park: Bulletin No. 8 of the Northumberland County Education Committee contains the results for the first 9 years, while 13 years are summarised in Bulletin 14.

Sevington: The Journal of the Bath and West Society for 1910 contains Mr. Ashcroft's report of 10 years' work.

The Cransley and other experiments supervised by the Agricultural Department of Cambridge University, are summarised in "Guide to Experiments," 1907.

The Highland Society and West of Scotland Agricultural

College joint experiments are reported on by Dr. Wilson and Mr. Hendrick in the Transactions of the Highland Society for 1905, p. 271, and 1908, p. 269.

Downan station is reported on by Professor Patrick Wright in "Reports on Experiments," 1905, p. 116.

Mr. Greig's report on the Kincardine and Ross stations is issued as Bulletin No. 16 of the Aberdeen and North of Scotland College of Agriculture.

Method of Summarising the Results.

In attempting to summarise the results, the following plan will be adopted:—The first nine years' work on the Tree Field at Cockle Park will first be reviewed and compared with the results obtained at Sevington and Cransley. Where strictly comparable, the results at these three stations will be looked at in the light of the figures produced at the other English stations, and at those in Scotland. The value of the live-weight increase is taken at 3d. per pound. Hitherto in the reports on the English stations this increase has been valued at 3¾d. per pound (4d. at Sevington), whereas in Scotland it has uniformly been valued at 3d. Dr. Wilson, in his report on the Scottish experiments, argues convincingly that 3d. per lb. is quite enough to put upon the live-weight increase. If this figure be adopted, it brings the butcher's estimate and the live-weight increase valuations at Cockle Park into very close agreement. (See page 5.) Moreover, the rate of 3d. per pound receives strong support from the results at Sevington. There the sheep have always been bought specially for the experiments, and at the end of the season they have all been sold. In the best year at Sevington (1905) 130 sheep were bought for £252 12*s*. 6*d*. delivered. They weighed 11,206 lbs. unfasted, or, deducting wool (900 lbs.), their net weight was 10,306 lbs. The wool realised £39 7s. 6d. so that the net cost of 10,306 lbs. (live weight) of sheep was £213 5s., which is just under 5d. per lb. During the course of the experiment two sheep went wrong and had to be sold at £1 each. Deducting these, we start with 10,134 live-weight pounds of sheep, costing £210 3s., after allowance is made for the two sheep at 31s. each shorn. The 128 sheep increased 4,828 lb. during the season, and sold

for £274 6s. 3d., equal to just under $4\frac{1}{2}$d. per lb. This means that there was $\frac{1}{2}$d. per lb. of loss between buying and selling. The difference between £274 6s. 3d. and £210 3s., namely, £64 3s. 3d., represents what the live-weight gain (4,828 lb.) realised, and this will be found to be 3·19d. per lb. Even in a good year it is evident that the live-weight increase cannot be put at much more than 3d. per lb., and in a bad season it will work out at much less. But in favour of taking 3d. per lb. as the basis of value three important considerations are to be urged. The first is that the increase made by the sheep during the summer is by no means a full statement of the benefits that follow the improvement of pasture. The autumn and winter grazing by sheep or cattle is also of considerable value, amounting, as it does at Cockle Park, to as much as 5s. 8d. per acre per annum on the best plot.* The second consideration is to be found in the fact that even at the end of nine years the benefits of the improvements are not nearly exhausted. (See p. 28.) The third consideration is not less important, namely, that the most was not being made out of the land by stocking with sheep alone. These animals had to be relied on because of considerations of fencing, the size of the plots, etc., but in practice cattle or horses would have been used to keep down the rough herbage, and they would not only have left something for their keep, but would actually have improved the pasture.

It is due to Mr. Ashcroft to point out that he thinks that the live weight increase should be valued at a higher rate than 3*d*. per lb., say $3\frac{3}{4}$*d*., or even 4*d*. He contends that in actual practice a farmer would purchase his stock on better terms than is possible where experimental plots have to be stocked at a definite period with a certain class of sheep. He points out, too, that farmers would generally purchase direct, and thus avoid the payment of a commission; and, by buying lambs in place of tegs, would save carriage. With Mr. Ashcroft's contentions I am in thorough agreement, and in adopting 3*d*. per lb. as the value of the live-weight increase, I believe that the case for the experiments is being understated rather than overstated. No single figure can be taken as absolute, but it is best to err, if err we must, on the safe side,

* See *Report for Nine Years*, p. 58.

and to adopt a figure which, taking one year with another, it is reasonably certain will be realised in practice, and this, I am satisfied, has been done. Moreover, it will be seen that at Cockle Park it brings the butcher's valuation into very close agreement with the other results. (See p. 5.)

In the reports that have hitherto appeared on the English stations the cost of the cake and manures has varied somewhat from place to place. This is partly accounted for by the fact that the manuring at Cockle Park did not fall in the same years as at the other stations, and partly by the fact that prices naturally vary somewhat in different parts of the country. This is especially the case with common lime, which can be bought at some 12s. per ton in the North of England, whereas it costs about double this amount in Hants. But there are obvious advantages in putting the materials at the same price at all the English stations, and the following rates have been adopted as a reasonable average, the dressings being calculated on this basis :—

	£	s.	d.	
Linseed cake	9	0	0	per ton
Decorticated cotton cake	8	0	0	,,
Common lime	0	15	0	,,
Ground lime	1	0	0	,,
Basic slag (40 per cent.)...	2	10	0	,,
Superphosphate (28 per cent.)	2	15	0	,,
Pure dissolved bones	5	10	0	,,
Sulphate of ammonia	12	0	0	,,
Sulphate of potash (23 per cent. K_2O) ...	4	6	8	,,

The prices affixed by the Highland Society and by Professor Wright in the case of the Scottish stations have been retained.

At the English stations, where a preliminary year's grazing was undertaken before the plots were dressed, the natural variations of the plots were not considered to fall outside the limits of experimental error. In the Scottish series of trials conducted by the Highland Society and the West of Scotland College of Agriculture, it was determined to base all the calculations of the results in the actual years of experiment on the variations as disclosed by the preliminary season's grazing. It is impossible to say which is the more reliable method of procedure, but in any case the main results would not be disturbed were the one system substituted for the other.

Proceeding now to discuss the effects of the separate

methods of treatment, we shall follow the order in which they are taken up at the principal English stations.

The Effects of Cake.

The results of giving cake to the sheep on Plot 1 may be looked at from two points of view, namely: first, the direct effects on the animals in the seasons when they received it, and, second, the indirect effects through the pasture that the cake residues have manured.

As regards direct effects, the results at every station show that an immediate loss invariably attended the use of cake, no matter whether it was Decorticated Cotton Cake, Rough Cotton Cake, a mixture of both, or Linseed Cake. The figures are brought together in Table VIII. It is just on poor

TABLE VIII.—Direct Results of the Use of Cake.

STATION.	Number of Years when Cake was used.	Kind of Cake.	Gross Weight of Cake consumed per Acre in these Years.	Total Cost of Cake per Acre in these Years.	Total Live-weight gained by the direct use of Cake.	Value of this Increase at 3*d.* per lb.	Direct Loss from the use of Cake.	Loss per Acre per Annum due to the use of Cake.
			lb.	£ *s.* *d.*	lb.	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*
Cockle Park .	4	Dec. cot.	2,388	8 10 0	438	5 9 6	3 0 6	0 15 1
Sevington .	4	,,	1,680	6 0 0	286	3 11 6	2 8 6	0 12 1
Cransley . .	2	,,	746	2 13 3	162	2 0 6	0 12 9	0 6 4
Hatley . .	2	Linseed	576	2 6 3	93	1 3 3	1 3 0	0 11 6
Yeldham . .	2	,,	1,036	4 3 3	176	2 4 0	1 19 3	0 19 7
Sunderland Hall	4	Equal parts of Dec. & common Cotton Cake.	1,240	3 4 7	171	2 2 9	1 1 10	0 5 5
Boon . .	4		2,044	6 2 6	322	4 0 6	2 2 0	0 10 7
Naemoor . .	4		870	2 6 4	105	1 6 3	1 0 1	0 5 0
Holstane . .	5		1,260	2 18 1	115	1 8 9	1 9 4	0 5 10
Hillridge . .	5		1,362	3 13 0	86	1 1 6	2 11 6	0 10 4
Boreland . .	5		1,026	2 15 8	113	1 8 3	1 7 5	0 5 6

pasture that cake has the best opportunity of showing its effects, and yet these experiments prove conclusively that in the conversion of store tegs into mutton by summer-grazing, the use of cake all through the season must result in a direct loss. One of the most striking features of the experiments was the regular and consistent way in which the live-weight gain fell off as the season advanced, being very low in the fourth and fifth months. If cake is to be fed at all that is the time to use it, and probably it may often pay when given at that time, but only in very exceptional cases can its use

be profitable in the early part of the season, assuming that the pastures are clean and fairly fresh.

Not only does cake give a disappointing return throughout the grazing season as a whole, but its effects in the latter part of the season are also poor. At Sevington, for instance, in 1902 the gains per acre per month were as follows for all the sheep (9) that went through the season from start to finish on Plots 1 and 3:—

	Sevington.	
	Plot 1. Sheep getting cake.	Plot 3. No cake. ½ Ton slag applied for previous season.
	lb.	lb.
1st month ...	67	57
2nd ,, ...	41	41
3rd ,, ...	35	36
4th ,, ...	16	30
5th ,, ...	12 (loss)	1 (loss)
Total ...	147	163

It will be seen that although the gain on the cake plot was greater in the first month than on Plot 3, the gains in the next three months were no greater with cake than on the plot where sheep got no cake, but had the benefit of the improved pasture produced by Basic Slag. In the last month the cake was less able to arrest loss of weight in the sheep than was the Basic Slag of Plot 3.

The other question regarding the use of cake is concerned with the effects of the manurial residues on the pastures.

At Cockle Park, Sevington, and Cransley, Decorticated Cotton Cake was fed for the first two years to the sheep on Plot 1, and for the next four years the sheep got nothing but pasture. In this way it was hoped to gain information as to the value of the residues of manure left by the consumption of the cake in the first two years. Table IX. brings together the figures for these stations, from which it will be seen that all the stations show the effects of cake-residues, which are greatest at Sevington and least at Cransley. Working out the values of the residues on the basis of the live-weight increase produced, we get the figures on the last line of the

Table, and these show that at two of the stations the residual values are higher than is perhaps usually supposed.

TABLE IX.—Residual Effects of Cake.

Cockle Park.		Sevington.		Cransley.	
The four Years immediately succeeding the two in which Cake was used.	Live-weight Gain per Acre over unmanured Plot.	The four Years immediately succeeding the two in which Cake was used.	Live-weight Gain per Acre over unmanured Plot.	The four Years immediately succeeding the two in which cake was used.	Live-weight Gain per Acre over unmanured Plot.
	lb.		lb.		lb.
1899	58	1903 ...	31	1903 ...	16
1900	36	1904 ...	36	1904 ...	9
1901	28	1905 ...	33	1905 ...	2
1902	30	1906 ...	0	1906 ...	4
Total ...	152		100		31
	£ s. d.		£ s. d.		£ s. d.
Value at 3*d*. per lb. ...	1 18 0		1 5 0		0 7 9
Weight of Dec. Cot. Cake consumed ...	1,194 lb.		597 lb.		746 lb.
Apparent value of Cake Residues per ton of Cake consumed ...	£ s. d. 3 11 0		£ s. d. 4 14 0		£ s. d 1 3 0

TABLE X.—Direct and Residual Effects of Cake.

Station.	Weight of Cake used per Acre in two Years.	Cost of Cake.	Total Live-weight gained directly in two Years and indirectly in four Years by the use of the Cake.	Value of the Live-weight increase at 3*d*. per lb.	Gain (+) or Loss (−) from the use of the Cake.
	lb.	£ s. d.	lb.	£ s. d.	£ s. d.
Cockle Park ...	1,194	4 5 0	286	3 11 6	−0 13 6
Sevington ...	597	2 2 6	189	2 7 3	+0 4 9
Cransley ...	746	2 13 3	193	2 8 3	−0 5 0

On the assumption that the manurial residues are practically exhausted by the end of the fourth year after the use of cake has been discontinued, we may see how cake has paid on the whole, that is to say, taking both direct and indirect effects into account. This is shown in Table X., where it will be seen that at two of the three stations the cake has left a deficit, while at Sevington there is a small credit balance. In 1907 and 1908 the use of cake was resumed at Sevington, and again the direct returns resulted in a loss, 193 lbs. per acre

of live-weight increase worth 48s. 3d. being all that was secured for an expenditure on cake of £3 17s. 6d.

The figures dealing with cake-residues at five other stations are inserted in Table XI., and they also show that, at many stations, the after-effects of cake are very small.

TABLE XI.—Effects of Cake Residues at Minor Stations.

	No. of Years Cake consumed.	Quantity used per Acre.	No of Years Res dues tested.	Live-weight Gain pro-duced by Residues.	Value of Live-weight.	Value of the Cake Residues re-covered per ton of Cake consumed.
		lb.		lb.	£ s. d.	£ s. d.
Hatley	2	576	3	40	0 10 0	1 19 0
Yeldham ...	2	1,036	1	14	0 3 6	0 7 6
Sunderland Hall	4	1,240	2	21	0 5 3	0 9 6
Boon *	4	2,044	2	52	0 13 0	0 14 3
Naemoor ...	4	870	2	12	0 3 0	0 7 8

* Cattle-grazing rather obscured this matter at Boon.

In summing up the results of the Scottish experiments, Mr. Hendrick, the chemist of the Society, states: "The feeding of cake gave the worst return of all for the expenditure. So far as the experiments show, very little result is recoverable from the manure value of cake on these soils."

The question of the use of cake for stock on pasture is a very important one, whether regarded from the point of view of profit on the stock, or of improvement of the pasture, or of both. If pasture is so poor that it will not fatten stock, a farmer should give very careful consideration to the subject before he decides to incur expenditure on cake. He would probably do better to change his system of farming, and to give up the fattening of stock, depending rather on the breeding of store stock. But if his grass-land responds to treatment with phosphates, there is no doubt as to the course he should pursue—no matter whether he feeds or breeds—and that is to dress with Basic Slag. In these experiments there have been many instances where sheep have actually increased more per head throughout the season, getting nothing but slagged pasture, than where, on untreated ground, they have been eating ½ to 1 lb. per head per day of high-class cake. (See p. 23.) In my opinion it is unprofitable, in the great majority of cases, to give cake to stock at grass, and the worst possible conditions for the use of cake are when it is

supplied to animals grazing land which itself has been improved by slag. Under these circumstances the nitrogen applied to the land through the manurial residues stimulates the grass, but not the clovers; the consequence being that the latter are rapidly suppressed, and the most valuable factor in a pasture is destroyed. Much light is thrown on this subject in an experiment which is being conducted at Cockle Park on a large area of land adjoining Tree Field, and a tentative report by Professor Gilchrist will be found in the Northumberland Bulletin, No. 14 (1910).

The Effects of Common Lime.

This is an old-established ameliorative agent, and many farmers expressed the view that it would give a good account of itself in competition with other forms of manure. Plot 2 at Cockle Park, Sevington, and Cransley was treated, for the first year, with ordinary burned lime at the rate of 4 tons per acre, which at Cockle Park was repeated for the seventh season. It became evident, as time went on, that any profit from the use of this substance was hopeless, and the plot at Sevington and Cransley was given over after the sixth year to another object. (See pp. 31–33.) But at Cockle Park the plot is still continued on the original plan, and in the fifteenth season since the first dose of lime was applied the position of this substance is practically as hopeless as ever.

TABLE XII.—Effects for Six Years of 4 tons of Lime per acre, applied in first year, costing £3.

	Live-weight Increase per Acre due to Lime.	Value of Increase at 3*d*. per lb.	Loss per Acre in Six Years.
	lb.	£ *s.* *d.*	£ *s.* *d.*
Cockle Park	66	0 16 6	2 3 6
Sevington	25	0 6 3	2 13 9
Cransley	43	0 10 9	2 9 3

In Table XII. I have set out the figures for the first six years at each of the stations that had a lime plot. The effects are very small, but even on the chalk soil at Sevington they are not altogether absent. The recovery of outlay, however, is so slow that as an agent for improving such pastures as we are now considering, common burned lime, used alone and at anything like the rate of 4 tons per acre, may be left

out of account. The effects of small quantities of ground lime will be considered later (p. 48), as also the effects of adding Basic Slag to the lime plot at Sevington and Cransley (pp. 31–33).

The Effects of 10 *cwt. per Acre of Basic Slag* (200 *lb.* P_2O_5) *applied in a Single Dressing.*

This treatment was given to one plot at all the stations except Downan, and it may at once be said that, on the whole, it has proved the most profitable of all, and generally so to a very marked extent. The figures are brought together in Table XIII., where it will be seen that, after deducting the cost of the manure, a profit is left in every instance except two, namely, Hillridge, a farm situated at an altitude of 1,200 feet in Lanarkshire, and Glen Dye. In his report Mr. Hendrick explains that the slag plot at Hillridge was somewhat unfairly treated by reason of the unmanured plot being naturally somewhat superior to it. Had it received some consideration in respect of this, Mr. Hendrick says, "It would have shown a small balance after paying for the cost of the slag." Mr. Greig, in reporting on the five years' results at Glen Dye, states: "An application of 10 cwt. of basic slag per acre has therefore proved the most satisfactory,

TABLE XIII.—Effects of 10 cwt. Basic Slag per Acre.

	Number of Years since the Slag was Applied.	Live-weight Increase per Acre over Untreated Plot.	Value of L.-W. Increase at 3*d*. per lb.	Nett Gain per Acre from use of Slag.	Nett Gain per Acre per Annum.
		lb.	£ *s*. *d*.	£ *s*. *d*.	£ *s*. *d*.
Cockle Park	9	719	8 19 9	7 14 9	0 17 2
Sevington	9	456	5 14 0	4 9 0	0 9 11
Cransley	8	280	3 10 0	2 5 0	0 5 7
Hatley	5	354	4 8 6	3 3 6	0 12 8
Yeldham	3	206	2 11 6	1 6 6	0 8 10
Saxmundham	5	412	5 0 3	3 15 3	0 15 0
Sunderland Hall ...	6	232	2 18 0	1 13 6	0 5 7
Boon	6	*	*	0 7 10	0 1 4
Naemoor	6	166	2 1 6	0 16 6	0 2 9
Holestane *	6	120	1 10 0	0 5 0	0 0 10
Hillridge	6	53	0 13 3	0 11 9†	0 1 11†
Boreland	6	164	2 1 0	0 16 0	0 2 8
Glen Dye	5	92	1 3 0	0 7 4†	0 1 6†
Ardross	5	142	1 15 6	0 14 10‡	0 3 0

* Somewhat complicated by partial use of Cattle.
† Loss, which, however, at Hillridge, as pointed out by Mr. Hendrick, and at Glen Dye, as pointed out by Mr. Greig, is more apparent than real.
‡ Allowing for Cattle Grazing.

and if everything is taken into consideration it is even profitable."

It will be observed from the Table that the profits have been secured in a period varying between three and nine years. With hardly an exception the slag has acted better in England than in Scotland. This is, no doubt, partly due to the fact that the Scottish stations are all at high elevations—600 feet and over—where the length of the growing season is more limited than at low altitudes, and where, consequently, the opportunity of effecting growth is more restricted. No English station except Cransley is more than half as high as the lowest Scottish station which is concerned with this problem. But altitude alone cannot account for the difference, nor do considerations of latitude help much, seeing that the most northerly English station (Cockle Park) is but little further south than some of the Scottish stations. The difference probably lies chiefly in the soil, which in England, on the whole, is better adapted to the growth of White Clover, and consequently to the action of slag, for without leguminous herbage to act upon, and especially white clover, Basic Slag is comparatively inoperative.

One of the most striking results in these experiments is the persistency in the action of Basic Slag. In the ninth year from the time of application, the residues are very large at Cockle Park and Sevington, and although the other stations have not been carried on so long, they show the same tendency. The matter is summarised in the following tabular statement, the method of estimation being to take the live-weight gain in the last year in excess of that on the unmanured land, and value it at 3d. per lb. :—

	Cockle Park.	Sevington.	Cransley.	Hatley.	Yeldham.	Saxmundham.	Sunderland Hall.	Boon.	Naemoor.	Holestane.	Hillridge.	Boreland.	Glen Dye.	Ardross.
Years since slag applied	9	9	8	5	3	5	6	6	6	6	6	6	5	5
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Value per acre by which the slagged land exceeds untreated land in last year	8 3	16 6	6 9	7 6	12 0	7 6	12 3	5 6	7 3	none	1 6	6 0	5 6	4 9

From these figures it will be seen that in the ninth year the value of the grazing per acre, in the case of land receiving 10 cwt. of Basic Slag nine years before, and nothing in the interval, is worth 8s. 3d. per acre more at Cockle Park, and 16s. 6d. more at Sevington. The figures below the other stations speak for themselves, and need not be repeated. These results cannot be characterised as anything else than very remarkable. Not only has the initial cost of the manure in the great majority of cases been recovered—in many instances several times over—but at the end of many years the annual value of the land is frequently double, or more than double, what it was to start with. This persistency in the action of Basic Slag, and of phosphatic manures generally, when applied to pasture, is doubtless in large measure due to the accumulations of nitrogen stored up in the land as a result of the stimulus imparted to the leguminous plants.

TABLE XIV.—Amount in Live-weight Pounds per Acre by which Plots 3 and 4 exceeded the Unmanured Plot.

	COCKLE PARK.		SEVINGTON.		CRANSLEY.	
	Plot 3.	Plot 4.	Plot 3.	Plot 4.	Plot 3.	Plot 4.
	lb.	lb.	lb.	lb.	lb.	lb.
1st Year	40	7	20	6	41	20
2nd ,, ...	118	60	64	46	86	45
3rd ,, ...	163	65	49	33	41	20
Total for 3 years ...	321	132	133	85	168	85
4th Year	87	95	32	44	13	12
5th ,, ...	82	84	61	59	14	48
6th ,, ...	86	105	43	39	19	46
7th ,, ...	58	76	61	59	39	46
8th ,, ...	52	61	59	51	27	20
9th ,, ...	33	41	66	68	*	*
Total for 6 years † ...	398	462	322	320	112	172
Total for 9 years * ...	719	594	455	405	280	257

* Eight years at Cransley. † Five years at Cransley.

The Effects of 10 *cwt. per acre of Basic Slag applied in Two Dressings.*

At Cockle Park, Sevington, and Cransley, Plots 3 and 4 received 10 cwt. per acre of Basic Slag, which in the case of Plot 3 was all applied in the first year of the experiments, while Plot 4 received its allowance in two portions, namely, 5 cwt. in the first year and 5 cwt. at the beginning of the fourth. For the first three years, therefore, the comparison was between 10 cwt. and 5 cwt. per acre, and we may look for a moment at their relative effects. (Table XIV.) At Cockle Park the double dose of Basic Slag had in three years much more than double the effect of the smaller, at Cransley the effect is practically double, while at Sevington it is about 1½ times as great. If the increases in live-weight are worked out at 3d. per lb. it will be found that the larger dressing of slag has paid much better than the smaller. Professor Middleton, in the Ninth Annual Report of Experiments with Crops and Stock in Cumberland, Durham, and Northumberland, p. 73, argues that on poor grass-land, such as much of that under experiment, it is important to so stimulate the clover at the beginning of any improvement that it fills up the ground to the maximum extent. Probably this is the true explanation, but in any case the evidence of these experiments is strikingly in favour of liberal dressings of slag.

In the late autumn of the third year, that is to say, well ahead of the growing season of the fourth year, Plot 4 at each of these three stations received its other *quota* of Basic Slag. At Cockle Park (see lower half of Table XIV.) the effects were considerable in the ensuing season, at Sevington they were relatively still more evident, whereas at Cransley the supplementary dose of slag produced no immediate result. In the fifth and subsequent years Plot 4 at Cockle Park was always somewhat better than Plot 3, and for three years this was also the case at Cransley; whereas at Sevington the residues of 10 cwt. of basic slag produced more effect than did a fresh application of 5 cwt. of that substance. If the total effects of the use of additional slag be examined for the six years (five at Cransley), it will be seen that the supplementary dressing has proved very effective at Cockle Park and Cransley, but that it has barely equalled the residues on Plot 3 at Sevington. On the nine years at two

of the stations, and eight years at the other (Cransley) the nett profit per acre (see Tables IV., V., VI.) is greater where the 10 cwt. of slag was put on in one dose in the first year (Plot 3) than where it was put on in two equal portions, namely, for the first and fourth years (Plot 4), the respective advantages per acre in favour of the former method being £1 11s. 3d (Cockle Park), 12s. 9d. (Sevington), and 5s. 9d. (Cransley).

At Sevington and Cransley there is no evidence that the "condition" of Plot 4 is better than that of Plot 3 at the end of the ninth and eighth years respectively, though there is such evidence at Cockle Park. When the whole period of nine years is considered the evidence is conclusively in favour of a heavy dose of Basic Slag at one dressing, rather than the same amount of slag applied in two portions separated by a three-years' interval.

The effects of applying 5 *cwt. per Acre of Basic Slag in the height of Summer.*

As time went on it became evident that the dressing of four tons per acre of common lime applied to Plot 2 at Cockle Park, Sevington, and Cransley would furnish no results of positive utility. At the writer's suggestion it was therefore resolved to test the effects of putting 5 cwt. (100 lbs. P_2O_5) of Basic Slag per acre on to this plot at Sevington in the middle of the summer of the seventh season (1907). At the end of the second month's grazing at that station, therefore, namely on June 13th, the slag was applied, its action being helped by showery weather during the next few weeks. Up to this time Plot 2 had been but little better than Plot 6 (unmanured), but within a few weeks of the slag being put on its effects could be detected. In his report for that year Mr. Ashcroft says* :—"The application of 5 cwt. Basic Slag to this plot on June 13 wrought a marvellous transformation. It is commonly said Basic Slag requires time and plenty of rainfall before any effect can be seen, but by the August weighing, eight weeks afterwards, the change in the appearance of the plot was quite evident, and all through the following two months perfectly remarkable; plenty of healthy-looking small clover herbage all over the plot. It is most

* *Jour. Bath and West Soc.*, 1908, p. 115.

interesting to observe how immediately the sheep bear witness; . . . on Plot 2 the increase of weight per sheep in the fourth month was 9·1 lbs. No other plot approached that, not even where they were having cake, and the total increase for the fourth, fifth, and sixth months together was 17·6 lb., which again is higher than any other plot." In his report for the next season, the eighth, Mr. Ashcroft thus expresses himself*:—"Plot 2 (four tons of lime per acre for 1901, and 5 cwt. basic slag, June, 1907) furnished the most striking feature of the year, and I might well add of the whole course of the experiment. The addition of 5 cwt. Basic Slag, June, 1907, to a plot always up till then prejudicially affected in growth of herbage by a heavy dressing of lime in 1901, worked a marvellous effect. The change in the appearance of the plot had already begun by August, 1907, as I pointed out in my report for that year, but as soon as ever any chance of growth came this spring the plot became full of clover herbage, which grew so luxuriantly that 10 sheep were increased to 12 at the weighing in May, and to 14 at the weighing, July 2. The contrast between Plot 2 and all the other plots, so deficient, comparatively speaking, in clovers and bottom herbage, was extraordinary, and perhaps all the more so in a season little favourable to growth. From being at the very bottom of all the manured plots, and very often lower than the untreated one, Plot 2 jumps at once to the top, and gives a total increase of 594 lbs., a result which has never been obtained any season on any of the manured plots, and only exceeded by the sheep receiving 1 lb. of cake per day on Plot 1 in 1907 and 1908. In the third month the sheep on Plot 2 averaged an increase of 20·1 lbs. per sheep, beating the sheep on Plot 1 getting a pound of cake, which averaged 18 lbs. per sheep. The subplots cut and weighed give the same evidence; the average weight of grass cut on this plot for seven years is far and away less than that of any other: very little more than a half of the weight cut on the untreated plot (6)—to be exact, as 15 to 24—and yet, turning to this year's tables, it will be seen that considerably the highest weight is cut from No. 2, and the weight is more than double the amount produced on the untreated one, 511 lbs. against 230 lbs.; this result was

* *Jour. Bath and West Soc.*, 1909, p. 112.

entirely obtained by close bottom clover herbage, which hardly gave room for top grass to get away."

If we examine the figures obtained from the use of 5 cwt. basic slag at Sevington (a) on Plot 4, during the two seasons (1901–2) that followed its application to land that had not been limed, and (b) on Plot 2, during the two seasons (1908–9) that followed its application to land that had been limed some six years earlier, we find that under the latter conditions the effects of the slag are much greater. Under the circumstances indicated by (a) the live weight gain was 6+46=52 lb., while under the circumstances indicated by (b) they were 93+90=183 lb. The natural character of the two pairs of seasons concerned was not sufficiently different to account for the great difference in the effect of the manure, so that we must seek an explanation in another direction. The difference might be due to the fact that six years previously a moderate dose of lime had been applied to the land, and that, in some way, this had created conditions unusually favourable to the action of Basic Slag. It would certainly be very unexpected if, on a chalky soil, the addition of 4 tons of burned lime made any great difference to the soil-conditions. We shall see later (p. 48) that $1\frac{1}{2}$ tons of ground quicklime per acre were used at Cockle Park, Sevington, and Cransley on a plot that also received superphosphate, and that at Sevington this lime produced a perfectly insignificant increase in live-weight, only, in fact, 33 lbs. in nine years. There are, therefore, no indications, from the evidence forthcoming at Sevington, that the lime has had any material influence on the striking results obtained from the use of Basic Slag in June. The records of the Cransley experiments give strong support to this conclusion. At the end of the sixth season at that station 10 cwt. of Basic Slag was applied to Plot 2, which, as at Sevington, had got 4 tons per acre of lime for the first year of the experiment. The effects in the next two seasons (1907–8) are represented by the production of 33+53=86 lbs. live-weight increase beyond Plot 6 (the continuously unmanured plot). On comparing the effects of 10 cwt. Basic Slag when used at the beginning of the experiments on Plot 3, it is found that in the two immediately succeeding years (1901–2) the live-weight gain was 41+86=127 lbs. In the case of Cransley, therefore, where the slag

was applied to Plot 2 in winter, it showed no improved action in the presence of lime, in fact, quite the reverse. So far as the evidence is available, therefore, we are thrown back for an explanation on the fact that at Sevington the Basic Slag was applied to Plot 2 during the growing season, namely, on June 13. It would be unsafe to generalise from the results of a single test, and it is to be hoped that opportunities will be found to follow this matter up, but it may be that phosphatic dressings have most effect on pasture when they are applied at a time when plants, and especially clovers, are making their maximum seasonal growth. Whether this should prove to be the case or not, the fact remains that Basic Slag has acted at least as well when it was applied during summer, and there are circumstances where it must be specially convenient to farmers to get it on at that time. In summer the land is dry and carries the cart better, and thus the work is lighter on the horses. The weather is drier and less windy, and this is in favour of sowing. General farm work is often least pressing between finishing root-sowing and starting on the hay harvest, and some part of the time of men and horses might be filled up with carting and sowing manure. It is also to be remembered that Basic Slag can be bought at a less cost in June, when sales are low, than in November, when orders are abundant. Lastly, it may be mentioned that a knowledge that slag can be effectively applied in June may prove useful to an enterprising farmer who has entered on a farm at May Day or Whitsunday. If he followed present custom he would wait till autumn or winter before putting slag on to his pastures, and would get only a moderate result in the following season. But if he puts on slag directly he enters his farm he will get considerable return in the same season, and a maximum return in the next. There need be no fear that the stock will in any way suffer from grazing newly-slagged land. It is now some years since Mr. W. J. Malden called attention to the harmlessness of slag to stock, and the Sevington experience confirms his findings. The small amount of slag that stock may consume is likely to do them more good than harm. On the Continent farmers often deliberately mix phosphatic meal with cattle-food, so that grazing freshly slagged pastures is merely a variation of a common Continental practice.

The Effects of Re-dressing Slagged Land.

When experiments were started at Cockle Park in 1897 many, perhaps most, farmers held the opinion that while Basic Slag might produce a striking result when grass-land was for the first time treated with this manure, the results of a fresh application some years later would be comparatively inconspicuous. No doubt they had the analogy of lime in their minds when they gave expression to this opinion, but the action of lime is very different from the action of Basic Slag. The former attacks accumulations of inert humus, and rapidly converts them into plant-food, and it is evident that if these accumulations are used up there can be no opportunity for a fresh dressing of lime to produce any such effect as a first dressing. Slag, on the other hand, so far as we are aware, acts directly as a plant-food, so that when one dose is exhausted there would appear to be no reason why a second dose should not act very much like the first. Some light is thrown on the subject by these experiments. At Cockle Park, Sevington, and Cransley Plot 4 got 5 cwt. of Basic Slag for the first year, and the other 5 cwt. for the fourth. On Table XIV., where the returns of Plots 3 and 4 are shown for nine years (eight at Cransley), it will be seen that in the first, second and third years 10 cwt. of Basic Slag (Plot 3) invariably produced much more live-weight increase than 5 cwt. of Basic Slag (Plot 4). If we may assume, as seems reasonable, that the relative produce of the two plots at each station would have been approximately the same in the fourth, fifth and sixth years, as in the third year, had no further manure been applied; and, further, assuming that the aggregate live-weight gain on Plot 4 for the three years following the repeated dose of Basic Slag would have borne the same relationship to the produce during these years of Plot 3, as the total for the first three years of Plot 3 bears to the total of Plot 4 for these years, we get the figures in Table XV. Now, the difference between the actual live-weight gains and the gains that it is estimated would have been made had no second dose of Basic Slag been given, is the figure that we may legitimately ascribe to the action of the second 5 cwt. of slag, and these figures we may compare with the gains made by the original

TABLE XV.—Estimated Live-weight Increase, had no further dressing of Basic Slag been put on Plot 4, and the actual Live-weight Increase got by the repeated dressing of Slag.

YEAR.	COCKLE PARK.		SEVINGTON.		CRANSLEY.	
	Estimated L.-W. increase on Plot 4.	Actual L.-W. increase on Plot 4.	Estimated L.-W. increase on Plot 4.	Actual L.-W. increase on Plot 4.	Estimated L.-W. increase on Plot 4.	Actual L.-W. increase on Plot 4.
	lb.	lb.	lb.	lb.	lb.	lb.
4th	35	95	22	44	6	12
5th	33	84	41	59	7	48
6th	34	105	29	39	9	46
Total for the 3 years ...	105	284	87	142	23	106

TABLE XVI.—Comparative Effects of the First and Second 5 cwt. Doses of Basic Slag.

YEAR.	COCKLE PARK.		SEVINGTON.		CRANSLEY.	
	Live-weight Gain per Acre made by the first 5 cwt. Basic Slag.	Live-weight Gain per Acre estimated to be made by the second 5 cwt. Basic Slag.	Live-weight Gain per Acre made by the first 5 cwt. Basic Slag.	Live-weight Gain per Acre estimated to be made by the second 5 cwt. Basic Slag.	Live-weight Gain per Acre made by the first 5 cwt. Basic Slag.	Live-weight Gain per Acre estimated to be made by the second 5 cwt. Basic Slag.
	lb.	lb.	lb.	lb.	lb.	lb.
1st	7	60	6	22	20	6
2nd	60	51	46	18	45	41
3rd	65	71	33	10	20	37
Total for the 3 years...	132	179*	85	55 *	85	83 *

* These figures are not summations of the respective columns, but are the differences between the actual and estimated 3-year aggregates, as shown in the last line of Table XV.

5 cwt. of this manure. This is done in Table XVI., from which we see that at Cockle Park the second 5 cwt. of slag produced much more effect (179 lbs. live-weight increase) in the three years following its use than the first 5 cwt. (132 lbs. live-weight increase). At Cransley the effect of the first and second doses is practically identical (85 and 83 lbs. respectively), but at Sevington the second dose has not been nearly so effective as the first (as 55 to 85 lbs.). A point to be noted

is that the action of the second dose of slag is much more rapid than the first dose at both Cockle Park and Sevington, and this is what one would expect when it is remembered that there are a greater number of clover plants on the ground to respond to a second dose than was the case when the first dose was used. Of course, it is conceivable, that through time—and more so on some soils than others—land may become "white clover sick," just as it may become "sick" to cultivated red clover, but there is little indication of this at present.

At Cockle Park, where the "Manuring for Mutton" experiment has been continued beyond the nine years for which it was originally designed, we can see the effects of repeating the 10 cwt. dressing of slag on Plot 3 for 1906, and we can also see the results of a third and fourth dose of slag on Plot 4 for 1906 and 1909 respectively. The whole course of these two plots, and of Plot 6 (continuously unmanured) can be best followed graphically in Table XVII.

Taking, first of all, Plot 3, which got 10 cwt. of slag per acre for 1897, and nothing more till 1906, when it again got the same dressing, it will be seen that in 1898 and 1899 the yield mounted very rapidly, reaching its culmination in the latter year. In 1900 the fall was very striking, the loss in that year being much greater than the gain in the previous one. From this point on to the ninth year (1905) the reduction in mutton-production is very uniform, being arrested, though only temporarily, in 1902, which was a year very favourable for grazing, as is shown by the way in which the yield even of Plot 6 goes up in that year. In the ninth year, as will be seen, the yield of Plot 3 is still 10 lbs. above what it may be assumed to have started with before the slag was put on (see the beginning of the curve for Plot 6), and is 33 lbs. above the yield of Plot6 in the ninth year. In the autumn of that year 10 cwt. of slag was repeated on Plot 3, with the result that in the tenth season the mutton produced experiences a large increase, being, in fact, 62 lbs. above what it was in 1905. In 1907 the mutton produced is again 62 lbs. higher than in the previous year (1906), and that represents the culminating point of the second cycle, from which in 1908, 1909, and 1910 there is a gradual descent,

though not so marked as in the years following the previous culmination in 1899.

The history of Plot 4 is not less interesting, and may be similarly followed in Table XVII. Had not the dose of 5 cwt. of slag been repeated on this plot for 1900 the curve would certainly have come down in that year, but, as it is, it has markedly risen, but for one year only. It rises again in 1902, due, as has been said, to the favourable grazing conditions of that year. But from that point the line of descent runs practically parallel with the curve of Plot 3, reaching the lowest point in 1905. In the autumn of that year 5 cwt. of slag was put on Plot 4, and in 1906 the yield of mutton is markedly higher, as is also the case, though the rise is not so great, in 1907. From that point the yield drops abruptly, agreeing with Plot 3, and no doubt it would again have fallen about as much in 1909, had not the slag (5 cwt.) been repeated for that year. This dressing—the fourth—although it has been able to modify the descent, has not been able to arrest it, so that although this, the fourth, dose of slag has had considerable effect, its influence has been markedly less than any of the previous three. The present position of these plots opens up interesting possibilities of speculation as to what results the future holds, but these may be left to speak for themselves in due course.

The Comparative Effects of Basic Slag and Superphosphate of Lime.

Ten years ago, when the use of basic slag was less common than now, there was much diversity of opinion as to the comparative value of these two manures when applied to pasture. The matter was therefore included in the original scheme at Cockle Park, and in the duplicate stations at Sevington and Cransley. It also received attention at practically all the other English stations, as well as at Professor Wright's (Downan) in Scotland, but it was not included in the series of tests carried out by the Highland Society, or by the West of Scotland College of Agriculture. The basis of comparison in the investigations was the relative effects of equal quantities of insoluble phosphoric acid in basic slag, and of soluble phosphoric acid in superphosphate

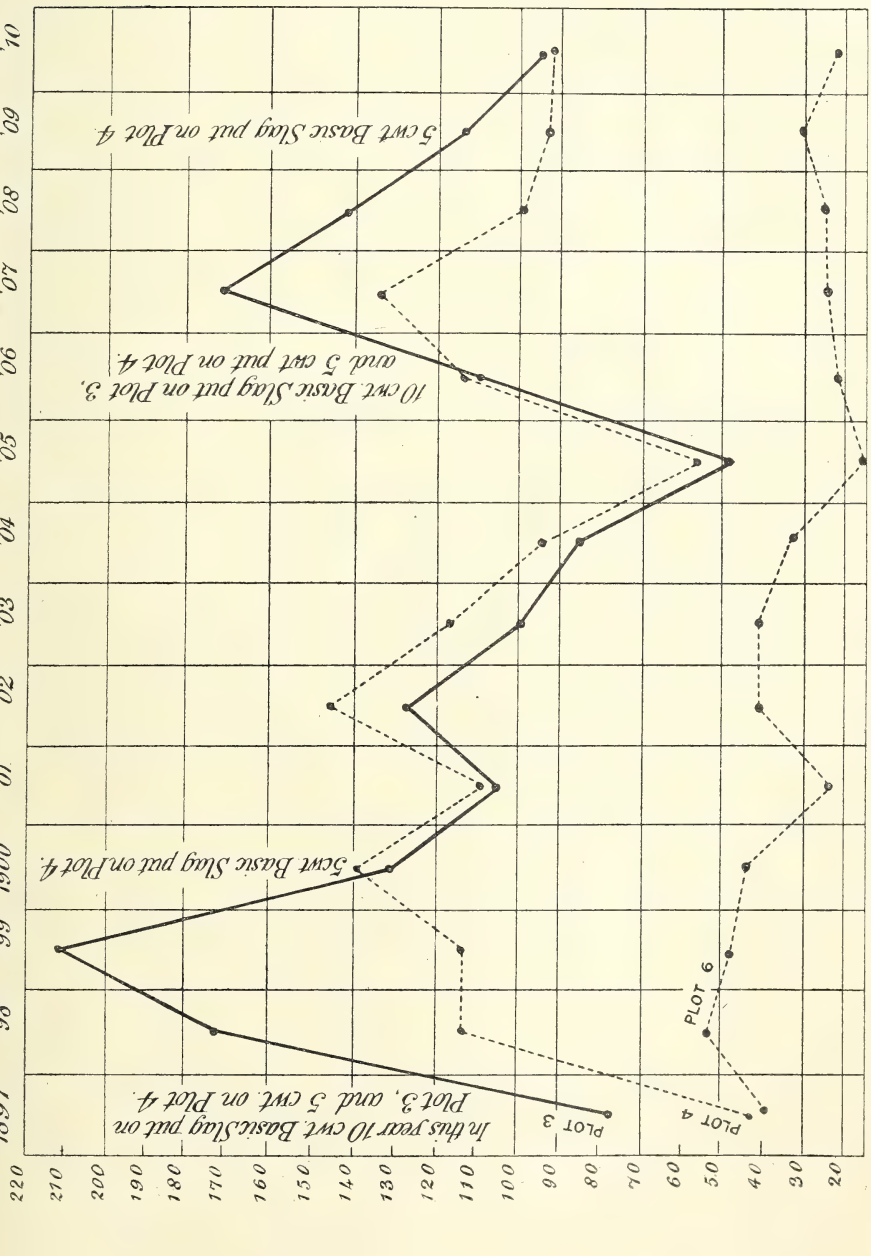


TABLE XVII.—Live-weight Increase (lb.) per Acre in 14 Years on Plots 3, 4, 6 at Cockle Park.

of lime, the insoluble phosphate being disregarded in the latter manure.

At Cockle Park, Sevington, Cransley, and Hatley, Plot 4 received 5 cwt. per acre of basic slag (100 lbs. P_2O_5) for the first year of the experiment, a further equal quantity being applied for the fourth season, after which no further manuring took place. At these stations Plot 5 received about 7 cwt. of superphosphate (100 lbs. P_2O_5) for the same seasons as those in which Plot 4 was dressed with slag, the slag being put on in autumn and the superphosphate in spring. At Yeldham the experiment was carried on for three years only, so that neither the slag nor the superphosphate was repeated. At the one Scottish station (Downan) making this test, 7½ cwt. of basic slag (120 lbs. P_2O_5) was applied per acre to one plot in spring, 1899, and in the month of January, 1901, the same plot received an additional dose of 5½ cwt. of slag (80 lbs. P_2O_5). The adjoining plot was at the same time dressed with 7½ and 5 cwt. of superphosphate, containing the same amount of phosphoric acid as was furnished by the slag. The stocking in the first year was not considered sufficiently well-arranged to make the figures for that year reliable, but those for the remaining five years are set out in Table XVIII., as are also those for the other stations. I have given the weights at each station for the individual years, as it is of interest to learn whether superphosphate is, as is alleged, more rapid in its action than slag.

The results are, without exception, in favour of Basic Slag whether judged by (a) the weight of mutton produced, or (b) the money gain. At one station (Sevington), which, as has been stated earlier, is situated on the chalk, superphosphate in the aggregate nearly approaches slag in its effects, but at all the other stations the excess of mutton to the credit of the slag is a very large one. If this is the case where the live-weight gain alone is considered, the superiority must necessarily be emphasised when the cost is taken into consideration. Average superphosphate costs more per ton than average Basic Slag, and as the latter manure contains, as a rule, a higher percentage of phosphates, it follows that the cost of the slag must be much less where equal weights of phosphoric acid are being used. The financial aspect is set

TABLE XVIII.—Increase in Live-weight per Acre, over Unmanured Plot, produced by Basic Slag and Superphosphate at Six Stations. Equal quantities of P_2O_5 in all Cases.

Year.	Cockle Park.		Sevington.		Cransley.		Hatley.		Yeldham.		Downan.	
	Slag.	Super.	Slag.	Super.	Slag.	Super.	Slag.	Super.	Slag.	Super.	Slag.	Super.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
1st	7	19	6	9	20	25	39	48	8	17	...	...
2nd	60	51	46	48	45	40	62	65	57	18	37	26
3rd	65	55	33	48	20	9	80	46	27	19	24	34
4th	95	93	44	46	12	2	93	63	...	...	49	37
5th	84	92	59	57	48	7	46	29	...	...	10	11
6th	105	86	39	46	46	21	...	...	...	...	31	23
7th	76	50	59	43	46	25	...	...	...	...	...	...
8th	61	45	51	45	20	40	...	...	...	...	...	...
9th	41	22	68	60	...	...	...	...	...	...	...	...
Total	594	513	405	402	257	169	320	251	92	54	151	131
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Cost of Manure ...	1 5 0	1 18 6	1 5 0	1 18 6	1 5 0	1 18 6	1 5 0	1 18 6	0 12 6	0 19 3	1 5 1	1 17 6
Value of the Live-weight Increase	7 8 6	6 8 3	5 1 3	5 0 6	3 4 3	2 2 3	4 0 0	3 2 9	1 3 0	0 13 6	1 17 9	1 12 9
Gain	6 3 6	4 9 9	3 16 3	3 2 0	1 19 3	0 3 9	2 15 0	1 4 3	0 10 6	0 5 9*	0 12 8	0 4 9*

* Loss.

out in the lower part of Table XVIII., where it will be seen that the slag has always left considerable, and often very large, profits, whereas at two stations the superphosphate has failed to leave a profit on three and five years' results respectively.

Table XVIII. also shows the results of these two manures year by year, and it is satisfactory to find that the popular belief that superphosphate is more rapid in its action than basic slag is confirmed. Without exception the superphosphate has always produced more mutton in the first year than the slag, but, except at Sevington and Hatley, the slag has always taken the lead in the second year.

As regards persistency, it may be pointed out that at every station, except Cransley, the slag has had more effect than the superphosphate in the last year of the experiment, and it is evident from the figures for the previous years that the exception at Cransley admits of explanation. On looking into the detailed monthly weighings of the individual sheep at this station for the last year of the experiment (1908), I find that two of the six sheep lost weight seriously in the last month on the slag plot, and that the superphosphate plot happens to have had a sheep which gained more in the season than any other animal on the ten plots. The exception at Cransley, therefore, is more apparent than real, and, in any case, the popular view that slag is more lasting than superphosphate is confirmed. As has already been mentioned, Plot 5 at Cransley suffered greatly, owing to its situation, from the excessive rainfall of 1903. This affected the weights of the sheep not only for that year, but also for the next two. Some allowance should therefore be made for Plot 5 on account of this circumstance.*

It is also interesting to note that the scientific view that the more alkaline a soil, the more does it favour an acid manure like superphosphate, is confirmed. Judged by the effect on the sheep the two manures have practically produced equal effects on the chalk at Sevington; it is only when the greater cost of the superphosphate is taken into account that the inferiority of that manure at this station becomes apparent.

* See interim Report on this experiment for 1901–3 by Professor Middleton, p. 22.

TABLE XIX.—Comparative Effects in Scotland of (*a*) Basic Slag and (*b*) Superphosphate *plus* Lime.

	Sunderland Hall.		Boon.		Naemoor.		Holestane.		Hillridge.		Boreland.	
	Basic Slag.	Super and Lime.	Basic Slag.	Super and Lime.	Basic Slag.	Super and Lime.	Basic Slag.	Super and Lime.	Basic Slag.	Super and Lime.	Basic Slag.	Super and Lime.
Live-weight increase (in lb.) over unmanured plot .	232	118	108½	84½	166	191½	120	159½	53	103	164	124
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Value of increase .	2 18 0	1 9 6	1 7 1	1 1 1	2 1 6	2 7 10	1 10 0	1 19 10	0 13 3	1 5 9	2 1 0	1 11 0
Cost of manure .	1 2 6	2 0 7	1 2 6	2 0 7	1 2 6	2 0 7	1 2 6	2 0 7	1 2 6	2 0 7	1 2 6	2 0 7
Gain or loss . .	1 15 6	0 11 1*	0 7 10†	0 18 6*†	0 19 0	0 7 3	0 5 9†	0 1 0*†	0 11 9*†	0 17 4*†	0 18 3†	0 11 3*†

* Loss. † Allowing something for cattle-grazing.

Although there was no perfectly direct comparison between slag and superphosphate in the experiments conducted by the Highland Society and the West of Scotland College of Agriculture, a modified comparison is possible, in as far as one plot got slag only, while another got superphosphate *plus* ground lime. In stating the results Mr. Hendrick says:* "An improvement was effected by all the manures, but of the manures used it is only basic slag which has in general effected sufficient improvement to make the application remunerative. Even in the case of Basic Slag, on the average three or four years elapsed before sufficient return was obtained to pay for the slag. On the other hand, the effect of the slag is by no means exhausted even after six years, but in the case of the majority of the experiments it is still giving as great, or nearly as great, returns as ever. Superphosphate and lime: though in all cases this dressing gave a considerable increase in mutton, it did not in general give sufficient return to be remunerative. In no case did it give so good a return as the cheaper dressing of slag alone." The results for the Scottish stations making this test are brought together in Table XIX., while those for Cockle Park, Sevington, and Cransley may be studied in Tables IV., V., and VI.

The Effects of adding Potash to Phosphate.

When these experiments were started an opinion was generally prevalent that much grass-land could be improved, quantitatively and economically, by the use of some form of potash along with phosphates, say superphosphate or basic slag. The testimony of Rothamsted is very strongly in favour of the use of potash in a grass manure, the gross yield of hay and the proportion of leguminous herbage being markedly increased on the plots where it has been employed. On two series of four stations each that I laid down in Cumberland in the winter of 1894–5, it was found that potash in the form of kainit had, by the fifth season, produced a conspicuous and consistent increase in the Leguminosæ.† On the Tree Field at Cockle Park, also, clovers, trefoil, meadow

* *Trans. High. Soc.*, 1908, p. 304.

† Somerville, "Influence of Manures on the Botanical Composition of permanent Grass-land," *Jour. Board of Agriculture*, vol. vii., p. 145.

TABLE XX.—Live-weight Increase Produced by Potash.

	Cockle Park.	Sevington.	Cransley.	Sunderland Hall.	Boon.	Naemoor.	Holestane.	Hillridge.	Boreland.	Downan.	Glen Dye.	Ardross.
No. of Years ...	9	9	8	6	6	6	6	6	6	6	5	5
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Phosphate alone ...	513	402	169	232	108	166	120	53	164	157	92	142
Phosphate and Potash	592	453	423	264	110	206	124	120	160	130	100	152
	£ s. d.	£ s. d.	£ s. d.	£ d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Gain when Phosphate only used...	4 9 9	3 2 0	0 3 9	1 15 6	0 7 10†	0 19 0	0 5 9†	0 11 9*†	0 18 3†	0 8 1†	0 7 4*	0 14 10†
Gain when Phosphate used with Potash	4 3 6	2 8 9	2 1 3	1 10 3	0 4 11*†	0 16 7	0 1 0*†	0 8 2*†	0 3 2†	0 19 5*†	1 3 1*	0 3 0†

* Loss. † Making allowance for certain cattle-grazing.

vetchling and the like, quickly responded to the addition of potash to superphosphate, and similarly at Sevington and Cransley. One would, therefore, expect stock to produce more meat on pasture treated with potash, and this has proved to be the case at most of the stations where the test was made.

The various stations, where potash entered into the scheme of experiment, have been brought together in Table XX. In every case there was a plot getting phosphate only (superphosphate at Cockle Park, Sevington, Cransley, and Downan, basic slag at the eight other stations), while another plot received potash in addition. In some instances this was kainit, in others sulphate or muriate of potash, but whatever the source of supply the manure was adjusted to furnish 150 lbs. per acre of pure potash (K_2O) at a cost of 26s. in the case of Cockle Park, Sevington, and Cransley, 100 lbs. at the six Highland Society and West of Scotland stations (cost 13s. 3d.), and at Glen Dye and Ardross (cost 18s. and 20s. 7d.), and 132 lbs. at a cost of 20s. 9d. at Downan. The phosphate was applied for the first and fourth years at Cockle Park, Sevington, and Cransley, while the potash at these stations was given in equal quantities (50 lbs. K_2O each) for the first, third, and seventh years. At Downan the phosphate and potash were given for the first and third years in the proportion of 1·5 to 1, while at the eight other stations both phosphate and potash were given in the first year only. The results, it will be seen from the table, are (*a*) that at every station except Boreland and Downan potash has added to the live-weight increase; and (*b*) that at only one station (Cransley) has the live-weight gain due to potash been got at a profit. At another (Hillridge, described by the Highland Society reporter as "light stony land") the phosphate-potash dressing has, it is true, involved a loss, but the loss is less than with phosphate alone, in other words, the 67 lbs. gained by the sheep (and after making some allowance for cattle grazing at this station) is of greater value than the cost of the potash. At three stations (Boon, Holestane and Downan) a profit gained by slag alone is converted into a loss where potash was used in addition. Looking a little beyond the mere figures, it is quite evident that the use of potash is not even justified at

Cransley. At that station the superphosphate plot (No. 5) did very badly for three seasons, being much injured by the excessive rainfall of 1903, so that it furnished a gross gain of only 3s. 9d. on the eight years' work. The adjoining plot (No. 4) getting a corresponding quantity of slag, has given a profit in the same time of 39s. 3d. Had potash been added to slag, instead of to superphosphate, it is practically certain that it would not have so increased the mutton-yield, over that got by slag alone, as to cover its cost. The more one experiments with potash on grass-land the more one realises how uncertain is its action. In the case of permanent grass-land mown every year, or most years, for hay, and receiving no farmyard manure, potash can often be used profitably in a mixture of artificial manures. Under these circumstances a large part of the potash taken up by the crop is carted off the land, and more must be added to provide for crop requirements. But even if this be called a general rule, it is at least one to which there are many exceptions. At Cockle Park, for instance, there are two experimental fields separated only by a highway. In the one a rotation experiment has been in progress for 14 years, and each time that the land comes under turnips the crop is practically a failure where nitrogen and phosphate are used, but no potash. On the other side of the road an experiment on a permanent meadow on somewhat stronger land has been in progress for the same length of time, and there potash is not only not required, but it actually does harm in most instances. On the average of 13 years on this grass-land, cut annually for hay, the following results have been obtained (the basis of annual manuring being 30 lbs. N supplied by sulphate of ammonia, 50 lbs. P_2O_5 supplied by superphosphate or slag, and 50 lbs. K_2O supplied by sulphate or muriate of potash) :—

Potash used alone has reduced the average crop by $3\frac{3}{4}$ cwt.
,, added to nitrogen ,, ,, ,, $3\frac{1}{2}$,,
,, ,, phosphate has increased the average crop by $1\frac{1}{4}$ cwt.
,, ,, nitrogen and phosphate has reduced the average crop by $\frac{1}{4}$ cwt.

Even in the thirteenth year the potash is acting no better than it did in the earlier years of the experiment. It is true that the hay grown by phosphate and potash was proved by experiment to be of higher feeding value than hay grown

with phosphate alone,* but for the moment we are estimating the results in the way that a farmer growing hay for sale would estimate them, namely, by determining the weight. The manuring of pasture must be considered from an entirely different standpoint than the manuring of a meadow, and this applies equally to the consideration of potash. The plants, both on the pasture and meadow, push their roots deep into soil and subsoil and bring up potash into their stems and leaves. When the herbage is made into hay the potash is removed from the field, but when it is consumed by pasturing stock very little is removed from the land. The great bulk simply passes through the animals' bodies, and is dropped upon the surface in the form of urine and dung. The plants continue to take as much potash as before from the deeper layers of the soil and from the subsoil, and, in addition, they have at their disposal the potash in the manurial residues. The latter source of supply is not at the disposal of the plants in a meadow, and as it is much more "available" than the original potash, it becomes evident why it can only be in very exceptional circumstances that it will pay to apply potash to a pasture.

The Effects of using Ground Lime with Superphosphate.

As has already been shown, the result of applying four tons per acre of common lime to Plot 2 at Cockle Park, Sevington, and Cransley was very small and quite incommensurate with the cost (see p. 26). At these three stations another plot (No. 8) was given over to a test with lime, but in this case the substance used was freshly burned lime which had been passed through a disintegrator, and was, in fact, the material known as "ground lime." It differs from ordinary lime, as used in agriculture, in being put on the land in the form of anhydrous oxide, CaO, whereas ordinary lime is first slaked before being spread, and is in the form of hydrated oxide, $Ca(OH)_2$. In point of fact it is to be doubted whether the effects of the two substances are materially different, for although much of the ground lime may be unslaked when put on the land, it must all slake in a very short time by taking water from the air or soil.

* Middleton, *6th Annual Report of Cockle Park*, p. 29.

The plot, in a sense, was put down to test the contention that basic slag owes some of its virtue to its containing a considerable percentage of anhydrous oxide of lime, which, of course, is "ground" in the process of disintegrating the slag.

Plots 5 and 8 are concerned with this test at each of the three stations indicated. Both plots received 100 lbs. per acre of phosphoric acid in the form of superphosphate for the first year of the experiments (1897 at Cockle Park, 1901 at the other two places), and again for the fourth year. In addition they received, at a separate operation, 10 cwt. of ground lime for the first, third and seventh years, making 1½ tons per acre in all, at an aggregate outlay for this material of 30s.

TABLE XXI.—Effects Produced by 30 cwt. Ground Lime, Applied in ½-ton Doses for the 1st, 3rd, and 7th Years.

Year.	Cockle Park.		Sevington.		Cransley.	
	Plot 5. Super without Lime. Live-weight Increase.	Plot 8. Super with Lime. Live-weight Increase.	Plot 5. Super without Lime. Live-weight Increase.	Plot 8. Super with Lime. Live-weight Increase.	Plot 5. Super without Lime. Live-weight Increase.	Plot 8. Super with Lime. Live-weight Increase.
	lb.	lb.	lb.	lb.	lb.	lb
1st	19	32	9	5*	25	29
2nd	51	66	48	32	40	67
3rd	55	66	48	53	9	53
4th	93	115	46	61	2	34
5th	92	121	57	68	7	62
6th	86	123	46	68	21	53
7th	50	79	43	48	25	60
8th	45	65	45	40	40	44
9th	22	46	60	70	†	†
Total	513	713	402	435	169	402
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Cost of Manure	1 18 6	3 8 6	1 18 6	3 8 6	1 18 6	3 8 6
Value of Live-weight Increase	6 8 3	8 18 3	5 0 6	5 8 9	2 2 3	5 0 6
Gain	4 9 9	5 9 9	3 2 0	2 0 3	0 3 9	1 12 0

* Loss. † Eight years only at Cransley.

The figures are brought together in Table XXI., where it will be seen that at Cockle Park and Cransley the yield of mutton on the limed plot is invariably greater than on the plot receiving the same amount of superphosphate, but no

lime. Also it is to be noted that the superiority of the limed plot is rather emphasised as time goes on—that is to say, as more lime is given—but that in the penultimate and last years, the beneficial action of lime seems to be on the wane. If, as is possible at Cockle Park, the subject were pursued beyond the ninth year, it would be found that this waning tendency becomes still more marked. It would appear, therefore, that the lime is acting rather as a liberator of inert nitrogen than as a direct plant food.

At Sevington, on the chalk, the results of the use of lime are somewhat different from what they are at the other stations. For the first two years after the first dose of lime was given it did positive harm, but from the third to the seventh years it caused the production of a considerably increased amount of mutton as compared with the unlimed plot. Thereafter the results are of a give and take character. At Sevington, therefore, as the lower part of Table XXI. shows, lime has not been used to advantage, the nett gain of £3 2s. on Plot 5 (without lime) being reduced to £2 0s. 3d. on Plot 8 (with lime). On the other hand, both at Cockle Park and Cransley the lime has caused such an increase in live-weight that its cost has been more than met, so that at Cockle Park a nett gain of £4 9s. 9d. (without lime) is raised to one of £5 9s. 9d. (with lime), while at Cransley a nett gain of 3s. 9d. is raised to one of 32s.* One can, therefore, say with some confidence that on clay soils, rather low in lime, it will pay to put on a moderate amount of ground lime or other form of calcium, if one is depending on superphosphate as the source of phosphoric acid. Referring to Tables IV., V., and VI., it will be seen that at each of the three stations under discussion the combination of 14 cwt. superphosphate and 30 cwt. ground lime (Plot 8) has produced more mutton than 10 cwt. basic slag containing the same amount of phosphoric acid, and applied for the same seasons (Plot 4). But as the latter dressing has cost (25s.) much less than the former (£3 8s. 6d.), the profits from the slag have always been considerably greater.

* This result at Cransley appears to be more favourable than it really is, seeing that the plot getting no lime was prejudicially affected by flooding in 1903.

In the series of experiments carried out by the Highland Society of Scotland and the West of Scotland College of Agriculture, to which reference has frequently been made, the question of the effect of ground lime was not gone into in as much detail as at Cockle Park, Sevington, and Cransley; but at each station there was a plot getting 9 cwt. superphosphate and 10 cwt. ground lime per acre, the former containing the same amount of phosphoric acid (200 lbs.) as another plot receiving 10 cwt. basic slag. We have, therefore, at these Scottish stations a test on the same lines as those referred to in the last paragraph, the only difference being that the amount of ground lime used in Scotland was 10 cwt. in six years, as against 30 cwt. in nine years (eight at Cransley). A summary of the results is shown on Table XIX., where it will be seen that on three occasions the basic slag produced most live-weight increase, while on three the order was reversed. But when the respective costs of the two dressings are considered there is no exception to the statement that the financial results of the use of basic slag are much superior to those that attended the use of superphosphate *plus* ground lime. Thus, at Sunderland Hall, Boon, Holestane and Boreland a gain from the use of basic slag becomes a loss where the slag is replaced by superphosphate and lime. At Naemoor both dressings have paid, but the profits from the super-lime plot are only 7s. 3d. per acre, as against 19s. where slag was used. At Hillridge neither dressing has paid, but whereas the loss from the use of slag is only 11s. 9d., it is 17s. 4d. on the other plot.

Of course, the quantity of free or "ground" lime in basic slag is but small, amounting, in the case of a half-ton dressing, to not more than 2 cwt. In the experiments that have just been discussed ground lime was being used at the rate of 10 cwt. and 30 cwt. per acre, so that it is not to be supposed that the increases in live-weight got from the free lime in, say, a half-ton dressing of slag are anything like those that are produced by the use of, say, half a ton of ground lime. The effect of the former must be very much smaller; but that the free lime in basic slag is of value admits of no doubt, though this value is quite insignificant as compared with the value of the phosphatic part of the manure.

The Effects of using Sulphate of Ammonia or Nitrate of Soda along with Superphosphate.

Of all manures that can be applied to grass-land, sulphate of ammonia and nitrate of soda are the most rapid in their action. Within a few days of their being applied in spring to a pasture or meadow one may have visible proof that they have already stimulated the plants. But not only are these two manures very rapid in their action, they are also the most powerful of any in increasing the yield of the herbage of grass-land. What with rapidity and intensity of action of these two manures it was decided that the matter was of sufficient importance to include sulphate of ammonia amongst the tests at Cockle Park. This manure was selected in preference to nitrate of soda because, while it is not so rapid in its action as the latter, it is more persistent, in this respect standing somewhere between nitrate of soda and, say, dissolved bones. Moreover, nitrate of soda, or even "nitrated" herbage, when consumed by stock is said to have undesirable effects on certain of their organs, and for these reasons, therefore, it was decided to use sulphate of ammonia and not nitrate of soda.

Sulphate of ammonia having been decided on for Cockle Park, it was therefore used at Sevington and Cransley, and was also included in the scheme for Yeldham.

The scheme of the West of Scotland College of Agriculture and of the Highland Society did not embrace this point, but it was included in Profesor Wright's Downan experiment, the manure used there being nitrate of soda.

In every case the arrangement of the experiment was a very simple one. At the three chief English centres one plot (No. 5) received superphosphate only, applied in the spring of the first and fourth seasons, while another plot (No. 9) got the same amount of superphosphate with the addition of a certain amount of sulphate of ammonia for the first, third, fourth, and seventh seasons. The quantity of sulphate of ammonia employed varied slightly at the different places, because it had to be adjusted to furnish a definite amount of nitrogen, and this, again, depended on the composition of the dissolved bones with which it was compared on another

plot. The actual quantities were: 84 lbs. (17 lbs. N) at each dressing at Cockle Park, 97 lbs. (20 lbs. N) at each dressing at Sevington, and 70 to 84 lbs. (14 to 17 lbs. N) at each dressing at Cransley. The aggregate cost per acre of the four dressings on the price basis given at p. 21 was 36s. at Cockle Park, 41s. 6d. at Sevington, and 30s. at Cransley. At Yeldham and Downan, there being no dissolved bones to consider, the quantity per acre of sulphate of ammonia used at the former, and of nitrate of soda at the latter, was:—

At Yeldham 100 lbs. sulphate of ammonia for the first and second seasons, and 200 lbs. for the third season, at a gross cost of 42*s.* 1*d.*

At Downan $1\frac{1}{2}$ cwt. nitrate of soda for the first, and 1 cwt. for the third seasons, at a cost of 22*s.* 9*d.*

At Yeldham the sulphate of ammonia was an addition to superphosphate, while at Downan the nitrate of soda was added to superphosphate and muriate of potash.

The results of this test are set out in Table XXII. The figures are given for each individual year in order that one may see whether the nitrogenous manure was markedly more effective in the season when it was used. The figures for these particular years are put in italics, and it may at once be said that there is no very distinct evidence of the manures being more effective in the year of application than in other years.

As regards the aggregate effect on the production of mutton it may be said that it is very different from what might have been expected. At Cockle Park and Sevington the mutton produced by superphosphate *plus* sulphate of ammonia is in almost every year less in quantity than that produced by superphosphate alone, and the drop in the aggregate yield is very striking. At Cransley the sulphate of ammonia appears to have added largely to the live-weight gains, but this result is somewhat illusory, for the reason that the superphosphate plot was partially spoiled for some years by the wet summer of 1903 (see p. 16). At Yeldham, where sulphate of ammonia was liberally used every year, a small live-weight gain over superphosphate only was got two years in three. At Downan there are both small gains and losses, the aggregate live-weight increase being somewhat higher where nitrate of soda was used than where it was withheld.

TABLE XXII.—Effects of using Sulphate of Ammonia and Nitrate of Soda,

Year	Cockle Park.		Sevington.		Cransley.		Yeldham.		Downan.	
	No Sul. Am. Live-weight Increase.	With Sul. Am. Live-weight Increase.	No Sul. Am. Live-weight Increase.	With Sul. Am. Live-weight Increase.	No. Sul. Am. Live-weight Increase.	With Sul. Am. Live-weight Increase.	No Sul. Am. Live-weight Increase.	With Sul. Am. Live-weight Increase.	No Nit. Soda Live-weight Increase.	With Nit. Soda. Live-weight Increase.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
1st	19	_42_	9	_14_*	25	_40_	17	_33_	22	_24_
2nd	51	41	48	20	40	42	18	_30_	29	41
3rd	55	_61_	48	_46_	9	_44_	19	_15_	34	_30_
4th	93	_84_	46	_31_	2	_25_	—	—	34	30
5th	92	75	57	25	7	25	—	—	14*	10*
6th	86	79	46	42	21	38	—	—	25	28
7th	50	_58_	43	_30_	25	_62_	—	—	—	—
8th	45	31	45	28	40	48	—	—	—	—
9th	22	15	60	68	†	†	—	—	—	—
Total for 9 years ...	513	486	402	276	169	324	54	78	130	143
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Cost of Manure...	1 18 6	3 14 6	1 18 6	4 0 0	1 18 6	3 8 6	0 19 3	3 1 4	2 18 3	4 1 0
Value of Live-weight Increase	6 8 3	6 1 6	5 0 6	3 9 0	2 2 3	4 1 0	0 13 6	0 19 6	1 12 6	1 15 9
Gain or Loss	4 9 9	2 7 0	3 2 0	0 11 0*	0 3 9	0 12 6	0 5 9*	2 1 10*	0 19 5*‡	1 13 7*‡

Figures in italics refer to years when nitrogen was given.

* Loss. † Eight years only at Cransley. ‡ Making allowance for some cattle-grazing.

Coming now to finance: it will be seen that the use of a nitrogenous manure has been well-nigh disastrous. At Cockle Park it has reduced a profit of £4 9s. 9d. to one of £2 7s., at Sevington a profit of £3 2s. is turned into a loss of 11s., while at Yeldham and Downan losses from the use of superphosphate, and superphosphate *plus* potash, respectively, are greatly intensified. The apparent financial improvement at Cransley is, as has been pointed out, not a real one, and may be disregarded.

The use of any nitrogenous manure along with phosphate on grass-land where phosphate stimulates clover to a marked extent must be condemned as bad practice. No doubt the nitrogenous manure brings early verdure over the pasture, and it does undoubtedly stimulate growth of grass, but the herbage so grown is very deficient in feeding properties, so much so, in fact, that the increased weight of food will produce less meat than the smaller yield grown by phosphate alone. What happens is this: the phosphate stimulates clover and the grass stimulated by the nitrogen smothers it. The two manures are consequently antagonistic. It is not necessary to reproduce the monthly weighings of the sheep, these may be studied for Cockle Park at p. 55 of Bulletin No. 8 of the Northumberland County Education Committee. But it may be said that even in the early part of the season, when a nitrogenous manure might be expected to be of benefit, no such benefit is traceable. As will be seen from Tables IV., V., VI., the sulphate of ammonia has largely increased the yield of herbage, but the sheep have proved that this herbage is of low feeding value.

The Effects of Dissolved Bones.

One plot (No. 10) was given up at Cockle Park, Sevington, and Cransley to seeing how this manure compared in its action with superphosphate and slag. The quantity (about 6 cwt. per acre) of dissolved bones given to Plot 10 in the first year contained the same amount of phosphoric acid (100 lbs.) as that supplied by 5 cwt. basic slag, or by 7 cwt. of superphosphate. When these manures were repeated on their respective plots for the fourth year, the dissolved bones were also repeated, so that a strict comparison as to (*a*) quantity,

and (*b*) time of application, is possible. The dissolved bones, of course, contain nitrogen, which is absent from the other two manures, and so on Plot 9 nitrogen was added to the superphosphate as sulphate of ammonia, the amount of nitrogen given to Plot 9 being in nine years (eight at Cransley) twice as great as that furnished by the dissolved bones in two dressings.

It may be said at once that dissolved bones have done badly—both quantitatively and economically. This result is no doubt due not so much to the poor action of their phosphate, as to the fact that they supply nitrogen. But bone nitrogen is not so energetic a substance as the nitrogen of sulphate of ammonia, and so the position of Plot 10 is not such a bad one as Plot 9. The mutton yielded by two doses of 5 cwt. each of basic slag has been much larger at Cockle Park and Sevington than that yielded by two doses of 6 cwt. each of dissolved bones. At Cransley, however, the dissolved bones have produced more live-weight yield than the slag, the aggregate increases over the unmanured plot in eight years being respectively 257 lbs. and 301 lbs.

When the cost of the two manures is taken into account the bad position of dissolved bones is made much worse. Thus at Cockle Park a nett gain of £6 3s. 6d. from the use of two 5 cwt. doses of slag compares with a nett gain of only £3 12s. 3d. from the use of two 6 cwt. doses of dissolved bones. At Sevington a nett gain of £3 16s. 3d. from slag has to compare with one of only 19s. 6d. from the use of dissolved bones. Even at Cransley, where the dissolved bones have done comparatively well, they show a nett gain in eight years of only 9s. 3d. per acre, as contrasted with 39s. 3d. in the case of basic slag (Plot 4).

Similarly the dissolved bones may be compared with a corresponding quantity of superphosphate given to Plot 5. At Cockle Park the gain from the former is £3 12s. 3d., from the latter it is £4 9s. 9d., while at Sevington the corresponding figures are 19s. 6d. and £3 2s. At Cransley this comparison cannot be made for reasons already given.

Dissolved bones, however, have always left a better profit than the combination of superphosphate and sulphate of ammonia.

Summary of Results.

1. Cake of various sorts was fed to sheep on pasture at 11 centres, and in no instance was the outlay on the cake recovered in the increased mutton produced by the sheep in the season when the cake was consumed.

2. In the latter part of the grazing season sheep getting liberal allowances of cake did not increase in weight to a greater extent than those getting no cake, but which were grazing pasture improved by liberal dressings of basic slag.

3. The residual values of cake were occasionally higher than is usually estimated, but, in comparison with basic slag, cake-residues had a poor ameliorative effect on the pasture.

4. Even when both direct and indirect effects of cake are taken into account, the original outlay was not recovered at two of the three main stations. This result was confirmed at such of the minor stations as were concerned with this problem.

5. It would appear to be bad practice to feed cake on pasture containing much clover, as the nitrogen in the cake residues has a tendency to repress the clovers by stimulating the non-leguminous plants.

6. Common burned lime, used alone at the rate of four tons per acre, has proved very ineffective; but smaller dressings of ground lime, when added to a phosphatic dressing, have sometimes been justified.

7. Basic slag applied as a single dressing at the rate of half a ton per acre, has generally proved a most effective agent in improving the feeding value of pasture, and its effects are not nearly exhausted at the end of nine years.

8. It has proved much more profitable to apply a heavy dose of basic slag as a single dressing, than to divide it into two equal portions and apply these with a three years interval.

9. A repeated dressing of basic slag has, however, had a marked effect in some cases, and the productiveness of slagged pastures that are showing signs of exhaustion can be rapidly improved in this way. The action of a repeated dressing appears to be more rapid in many cases than the action of the first dose.

10. Basic slag put on in the middle of June had much more effect than the same quantity applied in winter. Whether this result is of general application can only be determined by further experiments.

11. Where a direct comparison has been made between the effects of equal quantities of phosphoric acid derived from basic slag and superphosphate respectively, the former manure has always produced the greater amount of live-weight increase. When the cost of the manure is taken into account, the profits from the use of basic slag have always been much greater than those from superphosphate.

12. Potash added to a phosphatic dressing generally resulted in the production of more live-weight increase, but this increase was not a profitable one. The expediency of using potash on pastures—as contrasted with meadows—therefore, receives no support from these experiments.

13. The addition of moderate dressings of sulphate of ammonia or nitrate of soda to land already treated with phosphate has increased the yield of herbage, but has, as a rule, reduced the yield of mutton. The use of nitrogenous manures on pasture would, therefore, appear to be bad practice.

14. Dissolved bones compare badly with basic slag and superphosphate. This is doubtless due to two reasons: (*a*) the slower action of part of their phosphate, and (*b*) the presence of nitrogen. But the nitrogen of dissolved bones, being less active than that of sulphate of ammonia, the general effect on the sheep of the dissolved bones has been better than that of a mixture of superphosphate and sulphate of ammonia. The use, however, of dissolved bones on pasture would seldom appear to be justified, and especially so as their phosphoric acid costs more than the same substance in basic slag.

In conclusion I have to express my thanks to Mr. Ashcroft and Professor Gilchrist for having read proofs of this Report, and for useful suggestions which they have submitted.

RICHARD CLAY AND SONS, LTD., BREAD STREET HILL, E.C., AND BUNGAY, SUFFOLK.

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BY

WILLIAM SOMERVILLE, M.A. D.Sc.,

Sibthorpian Professor of Rural Economy, University of Oxford.

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